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JUL 79 J PEREZ , D M HOLLOWAY DACW43-78-C-0005

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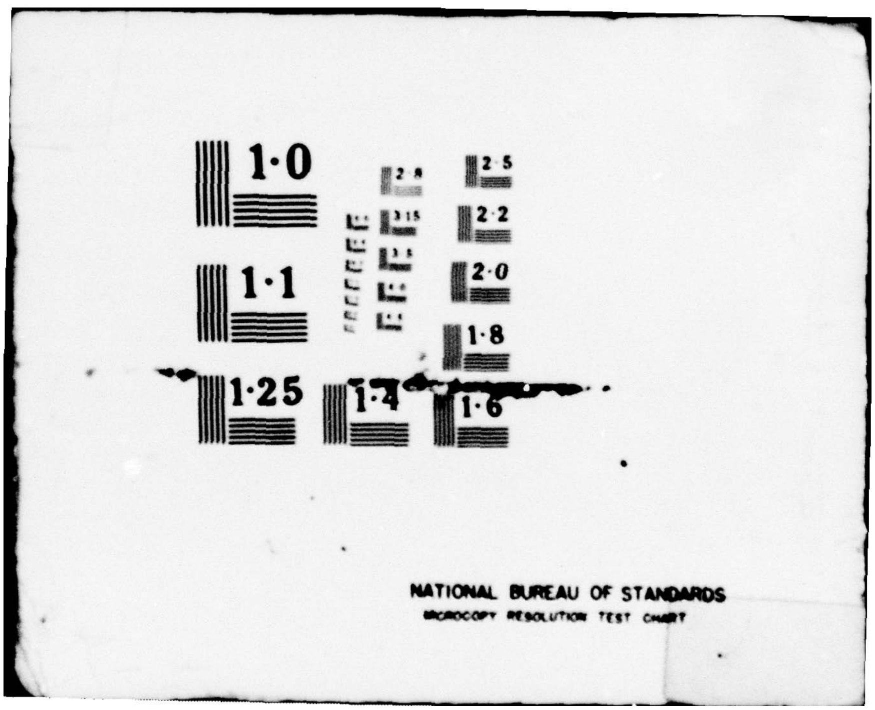
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PHASE IV REPORT

VOLUME IIIA

APPENDICES H THROUGH T

RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM

EXISTING LOCKS AND DAM NO. 26
MISSISSIPPI RIVER, ALTON, ILLINOIS

Prepared for

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

By

Woodward-Clyde Consultants
Chicago, Illinois

15 July 1979

Contract No. DACW43-78-C-0005

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PHASE IV REPORT

VOLUME IIIA

APPENDICES H THROUGH T

6

RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM

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Volume III A. Appendices H through T.
Phase IV Report.

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Vol III	Results and Interpretation of Pile Driving Effects Test Program
Vol IIIA	Appendices H through T, Results and Interpretation of Pile Driving Effects Test Program
Vol IV	Results and Interpretation of Drilled-In Pile Test Program
Vol IVA	Appendices A through E, Results and Interpretation of Drilled-In Pile Test Program
Vol V	Results and Interpretation of Rock Anchor Test Program
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Lock and Dam No. 26, Mississippi River	Timber piles
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Rock anchor test	Benoto method
Drilled-in pile test	Instrumentation of tests
Pile driving effects test	Vibrational effects on structures

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
A series of tests examining various foundation systems and construction techniques were conducted on Ellis Island near Locks and Dam No. 26 in alluvial sand deposits underlain by glacial deposits and limestone. The chemical grout test consisted of grouting the upper 20 feet of the alluvial sand by injecting a number of different silicate and cement-bentonite grout types, while varying the grouting method, hole spacing, and injecting rates. Heave, lateral displacement, and pore pressure were monitored during grout injection. The in situ properties of the sand were measured before and after grouting by standard

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20. penetration tests, static cone penetration tests, pressuremeter tests, bore hole permeability tests, and shear wave velocity tests. Concurrently laboratory tests were conducted to investigate the strength and creep behavior of the grouted sand. After completion of grouting, the site was excavated to examine and evaluate the grouted sand. In the rock anchor test, inclined rock anchors were installed in limestone through 130 feet of alluvial and glacial deposits using a pneumatic down-the-hole hammer with an offset reamer. Load tests were conducted on three instrumentated rock anchors and the feasibility of installation of the rock anchors was determined by evaluating loss of ground during installation, performance of the installation equipment, and rate of installation. The drilled-in pile test consisted of installation of large diameter high capacity pipe piles by the Benoto method. The feasibility of installing these piles was determined by evaluating loss of ground during installation, performance of the Benoto equipment, and rate of installation. In the pile driving effects test, pile founded monoliths were constructed, supported on either one, eight or twelve timber piles jetted and driven in alluvial sand to a depth of 35 feet. After applying lateral and vertical load to the monoliths, steel piles were driven at varying distances from the monoliths while monitoring movement of the monolith and supporting piles; shear, moment, and axial load in the timber piles; and pore pressure, movement, and particle velocity, in the soil. Parameters examined were pile type being driven (sheet, pipe, or H-pile), pile driving hammer (diesel, air-steam, or vibratory), distance of driven piles from monolith, driving of multiple piles at the same distance from the monolith, load level applied to the monolith, and soil properties (grouted and ungrouted). Vertical and lateral load tests were conducted on each pile founded monolith. Tests were also conducted to assess what effect grouted soil has on piles. Piles were driven in both grouted and ungrouted sand to examine driving characteristics and lateral load tests were conducted on H and pipe piles in both grouted and ungrouted sand.

RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM

VOLUME IIIA

PHASE IV REPORT

VOLUME IIIA

RESULTS AND INTERPRETATION OF
PILE DRIVING EFFECTS TEST PROGRAM

APPENDIX H

PREDICTED PERFORMANCE

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H.1 Backup for Fig. 2.6, Volume III

Data from Lo (1977)

Blowcount B blow/ft	Reference Velocity V_1 in./s	Rater hammer Energy E_{ram}, ft-lb 26,000	32,500	42,000
5		2.7	4.5	8.1
10		3.7	6.5	11.4
20		5.3	9.1	16.1
30		6.3	11.1	19.5
50		8.1	14	25
100		11.3	19.9	35

H.2 Backup for fig. 2.7, Volume III

Fig. 2.7, Volume III is based on data collected by Feagin (1936) at Dam No. 11, for monoliths 2 and 3. The data are presented in the following tables. Values in parentheses are normalized values of displacement $(\delta_H)_{10}$ for 10 hammer blows with respect to values of $(\delta_H)_{10}$ at r = 10 ft.

MONOLITH 2

$(\delta_H)_{10}$ CUMULATIVE HORIZONTAL DISPLACEMENT, in.

LATERAL LOAD t/pile	DISTANCE (ft) → 10	20	50	100	
2.5	0.0149# (1.0)##	0.0095 (0.638)	0.0015 (0.101)		○
3.5	0.021 (1.0)	0.011 (0.524)	0.002 (0.095)		△
4.5	0.022 (1.0)	0.013 (0.591)	0.0013 (0.059)	0.0005 (0.023)	□
6.5	0.0295 (1.0)	0.015 (0.509)	0.0010 (0.034)		⬡

MONOLITH 3

LATERAL LOAD t/pile	10	20	50	100	
2.5	0.0052 (1.0)	0.0019 (0.365)	0.0004 (0.077)	0.0004 (0.077)	●
3.5	0.0065 (1.0)	0.0037 (0.569)	0.0009 (0.139)	0.0003 (0.046)	▲
4.5	0.0085 (1.0)	0.0033 (0.388)	0.0012 (0.141)	0.0008 (0.094)	■
6.5	0.0195 (1.0)	0.0059 (0.303)	0.0025 (0.128)	0.0014 (0.072)	⬢

FEAGIN'S DATA (THESE VALUES WERE READ OFF FROM FIGURES)

DATA NORMALIZED WITH RESPECT TO THE VALUE AT 10 ft.

H.3 Backup for fig. 2.8, Volume III

$$V = V_1 \sqrt{\frac{1}{r}} \exp\left[-0.03(r-1)\right] \quad \text{(eq 2.2, Volume III)}$$

Assuming $V_1 = 2.5$ in./s for Feagin's (1936) test
(Feagin used a Vulcan 1 hammer, E ram = 15,000 ft-lb)
(blowcount was probably B = 60 blow/ft on the basis of wave equation analysis of timber pile driving).

@ r = 10 ft : $V = 2.5 \sqrt{\frac{1}{10}} \exp\left[-0.03(10-1)\right]$
$= 0.604$ in./s

@ r = 20 ft : $V = 2.5 \sqrt{\frac{1}{20}} \exp\left[-0.03(20-1)\right]$
$= 0.316$ in./s

Thus, from Fig. 2.7 (Volume III) and Section H.2 (Volume III A):
(Feagin's monolith 2)

Lateral Load t/pile	r = 10 ft $(\delta_H)_{10}$ in.	r = 10 ft δ_H/V in./in./s	r = 20 ft $(\delta_H)_{10}$ in.	r = 20 ft δ_H/V in./in./s
2.5	0.0149	0.025	0.0095	0.03
3.5	0.021	0.035	0.011	0.035
4.5	0.022	0.036	0.013	0.041
6.5	0.0295	0.049	0.015	0.047

H.4 Backup for fig. 2.12, Volume III

Values of reference velocity V_1, and values of velocity V at distance r can be obtained for the following conditions:

Vulcan 010 hammer (Eram = 32,500 ft-lb) @ { B = 10 blow/ft ; B = 50 blow/ft }

Delmag D22-02
Eram = 25,000 ft-lb @ B = 10 blow/ft
Eram = 39,780 ft-lb @ B = 50 blow/ft ,

using fig. 2.6 and eq 2.2 (Volume III):

B blow/ft	Vulcan 010 V_1, in./s	Delmag D22-02 V_1, in./s
10	6	3.3
50	13.5	24

then from $V = V_1 \sqrt{\frac{1}{r}} \exp[0.03(r-1)]$, fig 2.12 can be obtained.

H.5 Backup for fig. 2.9 and 2.10, Volume III

From fig. 2.12 and fig. 2.8 (Volume III):

$H_1 = 4$ t/pile : $\frac{\delta_H}{V} = 0.037 \frac{\text{in./10 blows}}{\text{in/s}}$

$H_2 = 6$ t/pile : $\frac{\delta_H}{V} = 0.046 \frac{\text{in./10 blows}}{\text{in./s}}$

For Vulcan 010 (fig. 2.9)

	r, ft	5	10	20	50	100
B = 10 blow/ft	V, in./s	2.38	1.45	- - -	- - -	- - -
	$(\delta_H)_{10}$, in/10 blows (for H_1)	0.088	0.054	- - -	- - -	- - -
	$(\delta_H)_{10}$, in/10 blows (for H_2)	0.109	0.068	- - -	- - -	- - -

Same procedure was followed for the other cases.

H.6 Backup for fig. 2.11, Volume III

fig. 2.11 was developed from results of wave equation analyses using the programs WEAP and PSI

Summary of results (WEAP):

Depth of Pile tip ft	R_{ult} t	Q_s t	Q_p t	E_{max} ft-k	Blowcount B blow/ft
15	34.5	7.9	26.6	21.9	3
↓	61	↓	53.1	23	5
	109		101.1	23	10
	198		190.1	22.2	24
	388		380.1	20.5	252
35	106	44.5	61.5	22.9	10
↓	171	↓	126.5	22.5	18
	298		253.5	21.3	87
	320		275.5	20.9	108
	566		521.5	18	∞
60	237.5	130.6	106.9	22.8	35
↓	344	↓	213.4	21.1	141
	557		426.4	18.2	∞

Vulcan 010 – HP 14×73

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Phase IV; Vol IIIA

(WEAP)

Depth of Pile Tip ft	R_{ult} t	Q_s t	Q_p t	E_{max} ft.k	Blowcount B blow/ft
15	25.5	4.6	20.9	19.7	3
	46.5		41.9	22.4	4
	84		79.4	23.4	7
	152.5		148.9	22.4	19
	302.5		297.9	18.3	184
35	72.5	23.9	48.6	22.7	7
	123.5		99.6	22.6	13
	223		199.1	20.3	52
	260		236.1	20.5	88
	280		256.1	20.4	119
	300		276.1	18.4	177
	432		408.1	15.6	∞
60	155.5	71.5	84	22.6	18
	239		167.5	20.5	71
	250		178.5	20.5	82
	275		203.5	20.5	119
	300		228.5	18.1	177
	406		334.5	15.9	∞

VULCAN 010 - PP14x0.375

SUMMARY OF PSI PROGRAM RESULTS

Depth of Pile Tip ft	Rult t	Qs t	Qp t	Emax ft-k	Blowcount B blw/ft
15	63.2	10.2	53	N/A	4
↓	116.2	↓	106	N/A	9
35	111.3	49.3	62	N/A	8
↓	173.3	↓	124	↓	15
	299.3		250		55
60	156.5	106.5	50	N/A	12
↓	206.5	↓	100	↓	16
	306.5		200		37

Vulcan 010 - HP 14x73

H.7 Backup for Fig. 2.13, Volume III

Detailed backup calculations are in Appendix D, Phase II Report, Project files. Results are based on WEAP analyses and parameters presented in Section 2.2.8, Volume III. Summary of results follows:

(a) HP 14x73

Depth of Pile Tip ft	Ungrouted Soil: Blowcount B blow/ft	Ungrouted Soil: σ^c_{max} k/in²	Grouted Soil: Blowcount B blow/ft	Grouted Soil: σ^c_{max} k/in²
5	1	23	3	23
10	4	23	9	23.5
15	6	23	12	23.5
20	8	23	15	24
25	11	23	11	23

(b) PP 14 x 0.375

5	1	24.5	5	25
10	2	24.5	7	25
15	4	25	9	25.5
20	6	25	11	25.5
25	7	25	7	25

H.8 Backup for fig. 2.14, Volume III

Backup for fig. 2.14 is provided in Appendix D, Table D.2 and fig. D.5 through D.10, Phase II Report, Project Files.

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RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM

APPENDIX I

INSTRUMENTATION DETAILS

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I INSTRUMENTATION DETAILS

I.1 DETAILED DESCRIPTION OF CYBER II

I.1.1 General

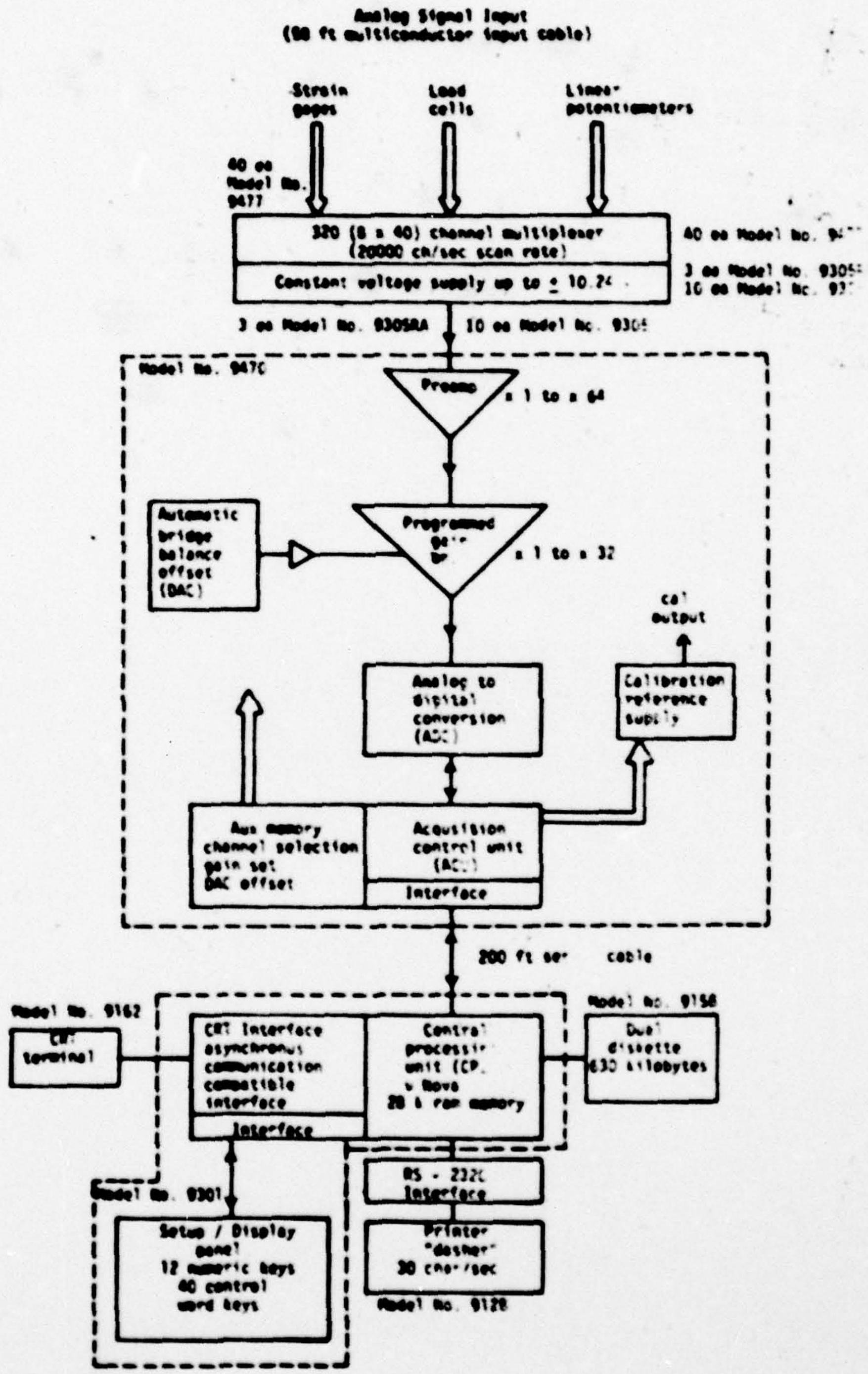
<u>Multichannel Computer-Based Scanner/Recorder</u>. Cyber II for data acquisition is a microcomputer system designed and programmed to automatically condition and acquire data from strain gages and other voltage or bridge-type transducers. The system may be operated by personnel not necessarily knowledgeable in computer operation and programming. The Cyber II is preprogrammed before delivery so that only setup information is entered to control the acquisition and recording of test data. All the information to the system may be entered via a key-based pad and display panel. The key base consists of numerical keys and command word keys.

The Cyber II has basically three separate modes of operation; setup, acquisition and playback. In the setup mode, the system reads the instructions as entered by the operator. In the acquisition mode, any selected channel can be monitored on the display panel. The other channels may be scanned at a maximum rate of 20,000 channels per second. The data are stored in the computer memory for later transfer to disk (dual floppy) storage and selective printing. For the playback mode the stored data may be recalled for inspection, further processing to engineering units and analytical studies by programming the computer.

The Pile Driving Effects Test requires that several hundred gages be read expediently for a very large number of test load steps. This large volume of data requires efficient reduction to engineering units and analysis. The multichannel data acquisition system selected (Cyber II) is 320 channels.

Intergrated in this system is a CRT terminal with an appropriate software package so that the test data may be inspected and partially evaluated before the data are stored on a dual floppy disk unit. The data stored on the disks may then be played back onto computer tape and entered into an outside computer with an appropriate processing program. This program will be tailor-made for the particular task to optimize the utilization of the test data through expedient data reduction and presentation.

I.1.2 Multichannel Data Acquisition System Schematic



I.1.3 Multichannel Data Acquisition System Components

ACQUISITION CONTROL UNIT

The Acquisition Control Unit offers several features which are designed to optimize the use of the CPU bandwidth and offer greater precision in sample time. The reason the microcomputer based system is able to provide operation at speeds comparable to the minicomputer is the use of this unique CYBER controller.

ANALOG-TO-DIGITAL CONVERTER

The Basic Acquisition Unit is equipped with a successive approximation analog-to-digital converter. The successive approximation ADC utilizes a sample and hold amplifier to sample the incoming data and hold this value while the ADC is performing the conversion. The unit is supplied as 11 bits plus sign as standard, and with speed ranges of 40,000 to 100,000 conversions per second.

PROGRAMMED GAIN AMPLIFIER

The input signal path consists of two preamplifiers followed by a programmable gain amplifier. The Basic Acquisition Unit is equipped with a programmed gain amplifier that provides full-scale input ranges of ±5 mv through 10.24V full-scale in 12 binary steps.

CALIBRATION

All systems are equipped with a programmable calibration reference supply to provide the system with an NBS traceable standard. The reference supply will output under computer control a DC voltage which is ±80% of each full-scale input range of the system.

Since values obtained from the calibration are used to correct all other data, it is desirable to read them with greater precision than normal data. Therefore, each data point taken during calibration is measured 16 times, and this data averaged to minimize the effects of system noise.

AUTOMATIC BRIDGE BALANCE

In systems having a number of bridge type channels, an automatic bridge balancing network provides much faster setup and greater flexibility to the user. In the CYBER SYSTEMS approach, a balance voltage is induced ahead of the programmed gain amplifier. The system first makes a tare run to measure the offset. Then, when measuring the signal, a compensating offset value is loaded via the controller into the DAC and the signal measured on a higher gain range.

AUTOMATIC RANGING

The system employs an automatic ranging feature that automatically selects the correct amplifier gain range for each measured channel. The system is set to maintain the signal level nominally between 40 and 80% of full-scale, except on the highest and lowest gain ranges.

AUXILIARY MEMORY

The controller contains an auxiliary memory (external to the computer memory) that is used to hold the channel sequence, the gain settings, and DAC offset values for automatic bridge balancing. This data is loaded automatically prior to the start of acquisition. During acquisition, the channel information is transferred to the front end equipment without further computer intervention. Only the incoming ADC data is transferred into the computer memory via the direct memory access channel. By eliminating the need to obtain the scanning information from the CPU memory, the data I/O loaded on the CPU is reduced by 66 percent.

REAL-TIME CLOCK

The controller also contains a programmable real-time clock which provides the timing for both channel-to-channel sampling rate and the time interval between scans.

PROGRAMMABLE SAMPLE RATE AND INTERVAL

The programmed sample rate allows the system to be tailored to the specific information bandwidth and recording capability of the application. The maximum sampling rate for low level signals is 20,000 channels per second and is program selectable downward by factors of two (i.e., 10,000 to 5,000, etc.). The interval between scans can vary from 10 milliseconds to 10 minutes.

PROGRAM SELECTABLE BANDWIDTH

The amplifiers and the offset DAC are wideband to minimize settling errors when the system is operated at high throughput rates. This system includes provisions for the selection of a HIGH/LOW amplifier bandwidth. This feature, used in conjunction with the programmable sample rate, allows the limiting of the noise bandwidth when permitted by the slower scan rates.

ANALOG-TO-DIGITAL ISOLATION

The controller is the place where the analog and digital grounds of the system are isolated to minimize the possibility of digital noise affecting the accuracy of the acquired signal.

The entire multiplexing, amplification and A-to-D conversion circuitry operates on a separate power supply and the signal information is transmitted serially over optical links. Besides providing the analog-to-digital isolation, this design allows the further benefit of remote operation of the analog equipment with a minimum of interface lines with all information transmitted digitally.

Further, the isolation allows several hundred volts of common mode voltage to exist between the analog and digital grounds. This is especially important when distances of hundreds of feet in an uncontrolled environment exist between the cluster of transducers to be measured and the digital system.

MODEL 9305 EXCITATION POWER SUPPLY

The Model 9305 Excitation Power Supply is a self-contained unit specifically designed for use with Strain Gauges, Load Cells, Pressure Transducers, Displacement Transducers and virtually all types of units requiring constant voltage excitation.

The output is continuously adjustable from 0 to 12 volts and a single power supply can operate up to 32 350-ohm bridges at full output voltage.

MODEL 9477 SIGNAL CONDITIONER/MULTIPLEXER

The Signal Conditioner/Multiplexer card provides conditioning for any combination of 1, 2, or 4-arm bridges and has provisions for completion networks, automatic resistance calibration, excitation power distribution and an 8-channel, 3-wire, low-level multiplexer. Input termination is by quick disconnect card edge connectors. Each transducer is provided with a 6-wire plus shield interface allowing high transducer accuracy by remote connection to the bridge.

The signal conditioning/multiplexer card contains provision for a single pole R-C filter per channel.

Twenty-four (24) channels (3 cards) may be contained in the main CYBER II chassis for small requirements. Up to sixteen cards, 128 channels are housed in each separate multiplexer chassis. A buss type addressing structure allows the system to support over 1000 channels through the use of additional chassis and plug-in cards.

SOFTWARE

CYBER II is provided as a complete turn-key system including all the software required for many applications. In addition, the system provides the flexibility to be easily tailored to meet a variety of non-standard applications. The basic system includes three (3) main programs. These are:

- Setup for acquiring data
- Acquisition and recording of data
- Playback of the previously recorded data

In the Setup mode, the operator inputs free form statements which supply setup parameters. It is possible to enter all the information to the system via the integral Setup and Display Panel. The Setup and Display Panel consists of a numerical keypad, a command keypad and a display. In the Setup Mode the system reads the instructions as entered by the operator and echos them on the display output. In the Display Mode any selected channel may be monitored during acquisition.

When used as a satellite to a host system all the setup information may be transmitted from the host to the CYBER II system allowing completely unattended operation. Interfacing to the host system is via an RS-232 port which allows the selection of virtually any host computer. The Setup and Display Panel may still be utilized when connected to a host system for maintenance and setup procedures.

Prior to the start of acquisition the system has provisions for automatic calibration and tare offset compensation. During acquisition, calibrations may be scheduled.

Also during acquisition, the system will limit check any previously specified channels and output up to 24 channels in engineering units for test monitoring purposes.

In the playback mode of operation, the system accesses the previously recorded data, applies the scale factors and calibration data as previously defined, and outputs the information to a selected device. The user may specify various non-linear transformations to be applied to the data in performing the conversion to engineering units.

Additional information concerning the software available with CYBER II is contained in the User Manual.

I.1.4 Multichannel Data Acquisition System Specifications

SYSTEM SPECIFICATIONS

Number of Inputs	8 channels per card, 24 channels in main chassis 128 channels in each expansion chassis 1024 channels maximum
Input Type	Guarded Differential, 3-wire MOS switch, fully protected
Input Range	±5 millivolts to ±10.24 volts in 12 binary ranges
Common Mode Voltage	±10 volts between channels ±200 volts between all channels and digital ground
Conditioning	Each channel includes provisions for 1, 2 or 4-arm bridge completion and resistance calibration. 6-wire input plus shield. Single-pole low pass filter
Offset	±80 millivolts unbalance compensation Resolution ±40 microvolts Stability ±1 microvolt @ zero
Scanning Rate	Programmable, binary steps from approximately 40 SPS to 40,000 SPS (20,000 SPS on low level signals)
Interval between Scans	Programmable 10 milliseconds to 650 seconds
Filter Amplifier	Programmable High/Low Range 2-pole Active 60 kHz Wideband 3 kHz Lowband
Calibration	Voltage programmable. ±4 millivolts to ±8.192 volts in 12 binary ranges. Accuracy ±0.015% of range ±3 microvolts Bridge. Programmable, single-point shunt resistor
Excitation Power Supply	Adjustable 0 to 12 volts

I.2 DESCRIPTION OF DYNAMIC DATA ACQUISITION SYSTEM

I.2.1 General. The description of the dynamic data acquisition system is shown in Fig. I.1.

A typical geophone and a schematic of the 3-D geophone arrangement is given in Fig. I.2.

I.2.2 Geophone Data : Analog to Digital Conversion

During Pile Driving Effects Test Program, 16 tracks of voltage vs time were recorded directly and continuously on analog magnetic tape using multi-channel tape recorders.

Selected tape data were played into an analog to digital conversion system and digitized for further evaluation using computer facilities. Most of the digitizing of these tapes was accomplished in the field using a BIOMATION TRANSIENT RECORDER (MODEL 1015) unit with an oscilloscope, a magnetic computer tape recorder (CYPHER) and an interface unit.

1.3 DETAILED DESCRIPTION OF THE PILE DRIVING ANALYZER SYSTEM

1.3.1 Measured Parameters

Dynamic measurements of strain and acceleration are made on piles near the butt during driving.

1.3.2 System Description

1.3.2.1 General. The Pile Driving Analyzer System is rented and consists of:

(1) set of two strain and two acceleration transducers mounted near the pile butt;

(2) field analog computer (Pile Driving Analyzer);

(3) two channel storage oscilloscope with mounted camera system;

(4) four-channel (analog) magnetic tape recorder; and

(5) pressure transducer (for monitoring combustion behavior of diesel hammers).

1.3.2.2 Principle of Operation. Pile acceleration and strain are measured near the top of the pile for each hammer blow. By inputting these measured quantities along with material properties and boundary conditions of the hammer-pile-soil system, the analyzer unit computes stress, velocity, transmitted energy, acceleration, and penetration resistance using a wave equation computer program.

1.3.3 Instrumentation System Specifications

1.3.3.1 Accelerometer.

Piezoelectric at 5 mv/g sensitivity; 1000 g range (Pile Dynamics, Inc).

1.3.3.2 Strain Transducer.

350 ohm full Wheatstone bridge; approximately 1% strain range (Pile Dynamics, Inc).

1.3.3.3 Connecting Cable.

10 conductor stranded wire; shielded in pairs.

1.3.3.4 Analyzer Unit.

(1) Type or Model No: Pile Dynamics, Inc Model EB, 3.5 digit LED panel displays one parameter, digital line printer for three selected peak quantities, analog output for seven different parameters; [illegible]

(2)	Size:	16-3/4 in. by 18-1/2 in. by 7-1/4 in.
(3)	Weight:	40 lb
(4)	Power Requirement:	115 V, ±10%, 48-66 Hz
(5)	Temperature Ranges:	
	Operation:	10°C to 45°C
	Printer:	0°C to 40°C
	Storage:	-50°C to +85°C
(6)	Input Impedance:	Greater than 10 k ohms;
(7)	Output Impedance:	Less than 10 ohms with 7 ma.

I.3.3.5 Portable Oscilloscope.

(1)	Type or Model No:	Tektronix 314, two-channel storage oscilloscope
(2)	Size:	4.4 in. by 9.3 in. by 13.6 in.
(3)	Weight:	10.5 lb
(4)	Power Requirement:	AC (90 V to 132 V or 180 V to 264 V at 48 Hz to 490 Hz with maximum power 29 W at 115 V); DC (11 V to 14 V or 22 V to 28 V with maximum current, 16. A at 12 V)
(5)	Temperature Range:	Operating, -15°C to +55°C
(6)	Sensitivity:	1 mV/div at 10 MHz
(7)	Integrate Mode:	Intensified signal for fast-rise-time low repetition - rate signals using auto-trigger and auto-erase (displays one- or two-channel signal for each blow with manual override to store one particular event)

I.3.3.6 Camera.

(1)	Type or Model No:	Tektronix C-30A scope-mounted camera with Polaroid film pack
(2)	Tape Recorder:	Tanberg Instrumentation (4-channel) Tape Recorder Series 115

I.3.4 **Installation Procedures**

Typical transducer mounting detail schematics for the timber piles, steel H piles, and steel pipe piles are given in Fig. I.4a . The transducers are bolted to the pile in predrilled holes after the pile is suspended in the leads. Wires from each transducer are collected nearby in a cable box with a single, multi-wire, shielded cable transmitting the signals to the Pile Driving Analyzer. Individual cables output the selected analog signals to both the oscilloscope and the tape recorder from the Pile Driving Analyzer, see Fig. I.4 b.

I.3.5 **Data Acquisition**

The measured quantities (strain and acceleration records) are simultaneously recorded on both the oscilloscope and the tape recorder through the field computer. The field computer outputs include: digital (paper tape) printout of peak values of measured/computed parameters (acceleration, force from strain, velocity, penetration resistance, and energy transmitted to the pile); and analog records of acceleration, velocity, force, energy, and/or pressure for visual display (oscilloscope) or permanent storage (on magnetic tape). Figure I.4 b shows the schematic diagram of Pile Driving Analyzer System typically used during pile driving in the field. Magnetic (analog) tape recordings are used as input data for further analyses in the office, with the component arrangement shown in Fig. I.4c .

PEAK VIBRATION MONITOR

Specifications - Sinco model S-4

Frequency Response:

Natural frequency of detector is 8 Hz
Flat within + 10% in terms of particle velocity from about 10 Hz to 150 Hz

Sensitivity Ranges: .05, .1, .2, .5, 1.0, 2.0, 5.0, 10.0, 20.0 in/sec. Full Scale

Trigger Level: 5, 10, 20, 30, 40, 50, 60, 70, 80, 90% Full Scale

Resolution: .0001 in/sec (.05, .1, .2 Ranges)
.001 in/sec (.5, 1.0, 2.0 Ranges)
.01 in/sec (5, 10, 20 Ranges)

System Accuracy: ±10% of Reading ±2% full scale at 20 Hz

Power Requirements: 20 watts, 115 V/230 V, 50/60 Hz

HONEYWELL
LIGHT BEAM RECORDER (OSCILLOGRAPH)

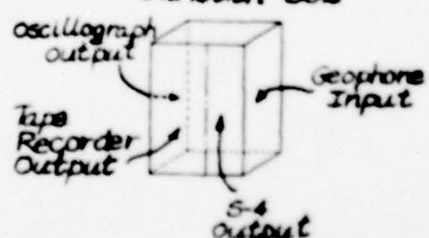
Model	1858 with 1883-MPD modules
Channels	18
Paper Width	8 in.
Frequency Response	5 KHz
Chart Speeds	0.1 - 120 in./s
Power Source	110 V AC

Function Generator

HEWLETT PACKARD
FM MAGNETIC TAPE RECORDER

Model	3960A
Channels	8
Tape Size	1/4 in.
Reel Size	7 in.
Tape Speeds	5/32-15 in./s
Power Source	110 V AC

Junction Box



PILE DRIVING EFFECTS TEST PROGRAM

DESCRIPTION OF DYNAMIC DATA ACQUISITION SYSTEM

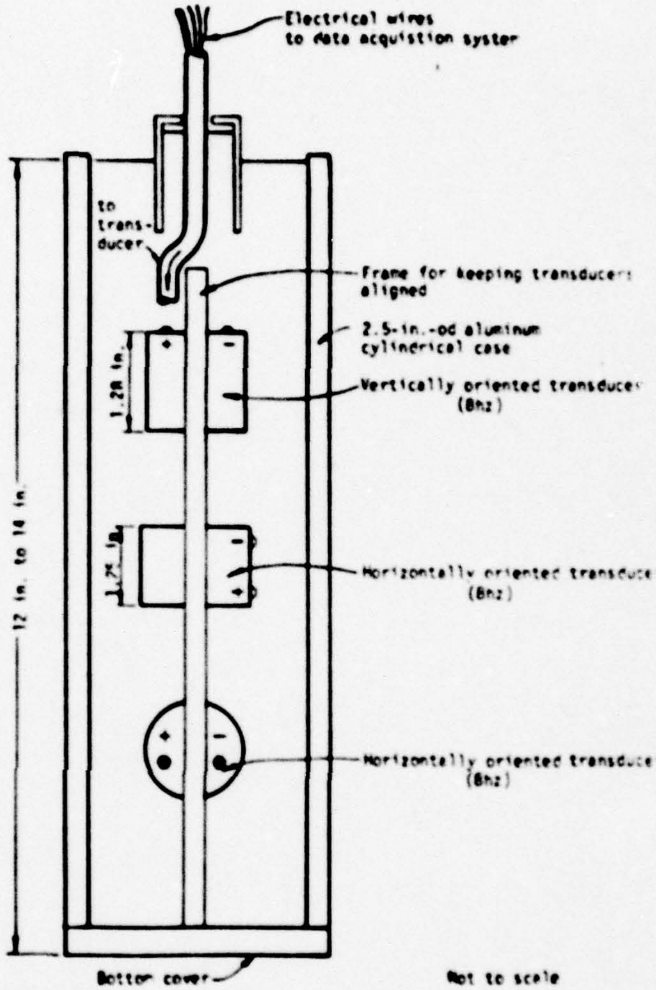
Fig. I1

L-15 Basic unit
(actual size)

GENERAL SPECIFICATIONS

Distortion....... Less than 0.2% @ 12 Hz with velocity of 0.7 in./sec. p-p
Standard frequency range......... 4.5 to 40 Hz
Frequency tolerance.......... ±0.5 Hz or ±5%
Standard coil resistances.... 24, 38, 60, 95, 150, 240, 380, 600, 960 ohms
Case to coil motion............ 0.080 inches p-p
Frequency change with tilt...... less than 0.1 Hz for vertical unit @ 20° (8 Hz)
Transduction (G)............ $G = 0.0487\sqrt{Rc}$ where G = volts/inch/sec.
Coil inductance (Lc)........ $Lc = 3.87 \cdot 10^{-4}\ Rc$ where Lc is in henries
Basic unit.............. Diameter – 1.25 inches
Weight – 5.3 ounces   Height – 1.28 inches

TYPICAL GEOPHONE TRANSDUCER ELEMENT



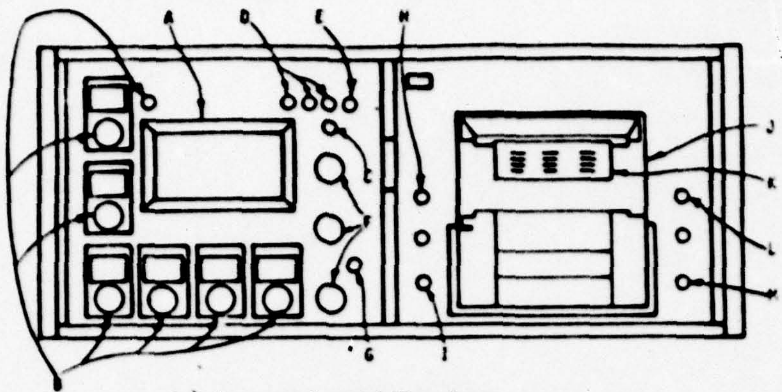
TYPICAL ARRANGEMENT OF 3-D GEOPHONE

PILE DRIVING EFFECTS TEST PROGRAM
GEOPHONE SPECIFICATIONS AND ARRANGEMENT

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-[illegible]

Woodward-Clyde Consultants
[illegible] Phase III

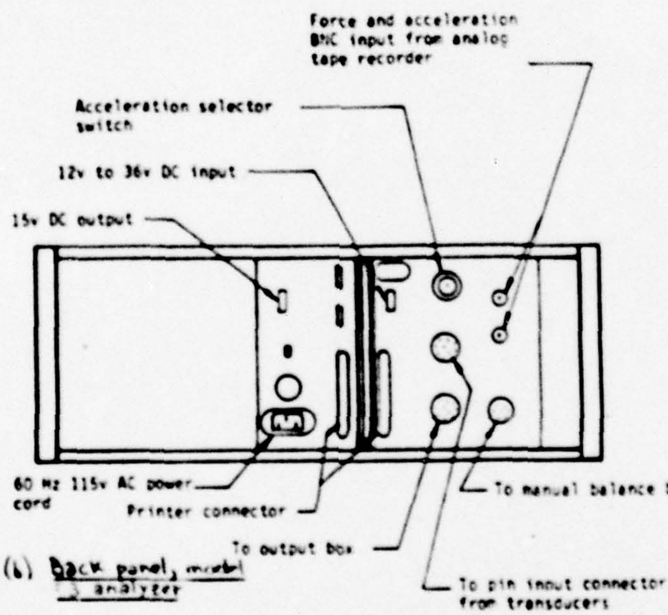
Fig. I2



(a) Front panel, model EB analyzer

LEGEND:

A. LED display
B. Calibration constant selection switches
C. Reset switch
D. Transducer function warning lights
E. Capacity prediction mode switch
F. Output selector switches
G. LED display selector switch
H. Operate - standby switch
I. On - off switch
J. Printer
K. Paper tape
L. Manual print
M. Paper advance



(b) Back panel, model EB analyzer

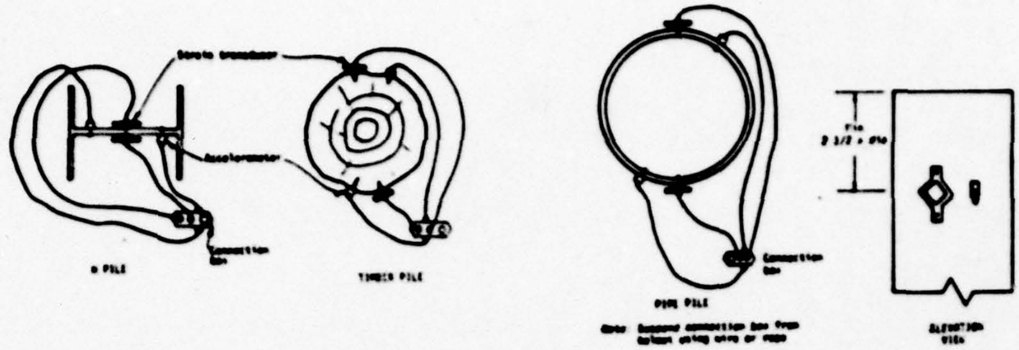
PILE DRIVING EFFECTS TEST PROGRAM

MODEL EB ANALYZER

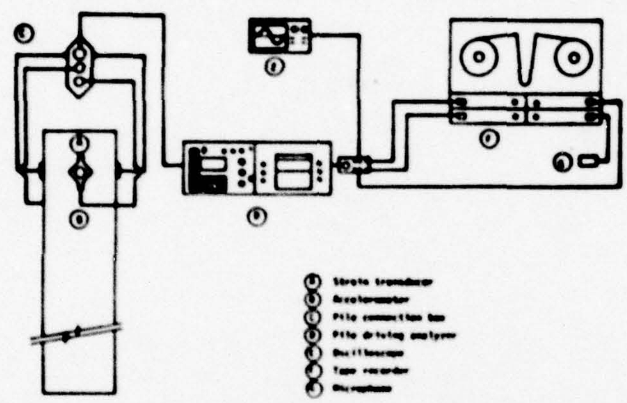
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
[illegible]

Woodward-Clyde Consultants
[illegible] Phase [illegible]

Fig. I. 3



(a)



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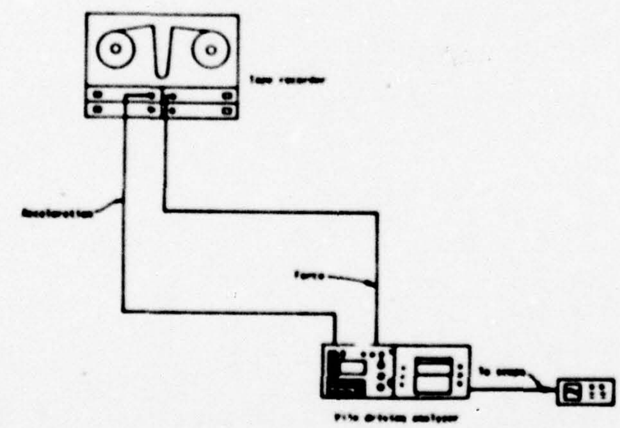

(c)

PILE DRIVING EFFECTS TEST PROGRAM

SCHEMATICS OF PILE DRIVING ANALYZER SYSTEM

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
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Fig. I.4

PHASE IV REPORT

VOLUME IIIA

RESULTS AND INTERPRETATION OF
PILE DRIVING EFFECTS TEST PROGRAM

APPENDIX J

TIMBER PILE CALIBRATION DETAILS

TABLE OF CONTENTS

J.1 TENSION AND COMPRESSION MODULI AND RANKS FOR GAGES ON TIMBER PILES UNDER MONOLITH M2

Gage No.	E_c $(10^3 \cdot k/in^2)$	E_t $(10^3 \cdot k/in^2)$	Rank
1-1	2.227	1.939	5
1-2	2.123	2.239	5
1-3	1.988	2.032	5
1-4	1.641	1.888	5
1-5	1.992	2.115	5
1-6	1.746	1.843	5
1-7	2.263	2.204	5
2-1	2.128	1.939	4
2-2	2.009	1.964	5
2-3	1.964	1.961	5
2-4	1.930	1.417	4
2-5	2.131	1.831	5
2-6	1.972	1.887	5
2-7	2.289	2.021	5
3-1	1.769	2.081	5
3-2	1.912	2.107	4
3-3	1.709	1.805	3
3-4	1.390	1.391	4
3-5	1.889	1.946	4
3-6	1.935	1.955	5
3-7	2.207	2.255	5
4-1	1.680	1.834	5
4-2	1.930	2.114	5
4-3	1.847	2.183	5
4-4	1.517	1.673	4
4-5	1.649	1.778	5
4-6	1.830	1.984	5
4-7	2.122	2.303	5

Notes:

E_c : modulus in compression

E_t : modulus in tension

PILE DRIVING EFFECTS TEST PROGRAM

TENSION AND COMPRESSION MODULI AND RANKS FOR GAGES OF TIMBER PILE No 14 MONOLITH M2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
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[illegible], Phase II, Vol III A

Table. J. 1

Gage No.	E_c (10^3 k/in^2)	E_t (10^3 k/in^2)	Rank
1-1	—	—	1
1-2	2.128	2.260	4
1-3	1.642	1.826	4
1-4	1.151	1.516	4
1-5	2.158	2.207	5
1-6	2.087	2.162	5
1-7	3.377	3.275	4
2-1	1.928	2.052	5
2-2	1.885	2.053	5
2-3	2.073	2.140	4
2-4	1.831	2.052	5
2-5	4.136	4.364	4
2-6	1.960	2.078	5
2-7	0.954	0.977	4
3-1	1.811	1.728	4
3-2	3.530	3.827	3
3-3	3.299	3.320	4
3-4	3.197	2.886	4
3-5	1.904	1.389	4
3-6	1.810	1.784	5
3-7	3.210	2.920	3
4-1	–	–	1
4-2	–	–	1
4-3	1.692	1.607	4
4-4	1.896	1.742	3
4-5	1.901	1.719	4
4-6	1.535	1.160	3
4-7	1.942	1.554	5

Notes:

E_c: modulus in compression

E_t: modulus in tension

PILE DRIVING EFFECTS TEST PROGRAM

TENSION AND COMPRESSION MODULI AND RANKS FOR GAGES OF TIMBER PILE No 30 MONOLITH M2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0002

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Table. J. 2

ST7C028, Phase II, Vol IIIA

Gage No.	E_c (10^3 k/in²)	E_t (10^3 k/in²)	Rank
1-1	1.706	1.624	5
1-2	1.816	1.279	2
1-3	1.914	1.825	5
1-4	1.846	1.699	5
1-5	1.956	1.724	5
1-6	1.972	1.824	5
1-7	2.065	1.898	5
2-1	1.560	1.588	5
2-2	1.434	1.479	4
2-3	1.480	1.485	4
2-4	2.004	1.914	5
2-5	1.677	1.309	5
2-6	1.729	1.739	5
2-7	1.641	1.655	5
3-1	1.633	1.680	5
3-2	1.643	1.716	5
3-3	1.636	1.713	5
3-4	1.992	1.995	5
3-5	1.986	1.851	5
3-6	1.801	1.810	5
3-7	1.894	1.920	5
4-1	1.691	1.713	5
4-2	1.713	1.712	5
4-3	1.653	1.693	5
4-4	1.769	1.841	5
4-5	1.288	1.346	4
4-6	1.809	1.814	5
4-7	1.829	1.793	5

Notes:

E_c modulus in compression

E_t modulus in tension

PILE DRIVING EFFECTS TEST PROGRAM

TENSION AND COMPRESSION MODULI AND RANKS FOR GAGES OF TIMBER PILE No 9 MONOLITH M2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-[illegible]

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Table. J. 3

[illegible] Phase II, Vol III A

Gage No.	E_c (10^3 k/in²)	E_t (10^3 k/in²)	Rank
1-1	2.383	1.825	5
1-2	2.283	1.962	5
1-3	1.852	1.521	5
1-4	2.142	1.973	4
1-5	2.564	2.184	3
1-6	2.157	1.872	5
1-7	1.737	1.782	5
2-1	1.890	2.043	5
2-2	1.732	1.864	5
2-3	1.920	2.062	5
2-4	1.813	1.922	5
2-5	1.844	1.920	4
2-6	2.094	2.209	5
2-7	1.824	1.946	5
3-1	1.881	2.596	4
3-2	2.356	2.461	4
3-3	2.040	2.352	5
3-4	1.699	1.875	5
3-5	1.680	1.649	5
3-6	2.068	2.471	5
3-7	1.848	2.035	5
4-1	1.745	2.086	5
4-2	2.268	0.32 ?	2
4-3	1.615	1.907	5
4-4	1.675	1.758	5
4-5	1.993	1.878	5
4-6	1.874	1.918	5
4-7	—	—	0

Notes:

E_c modulus in compression

E_t modulus in tension

PILE DRIVING EFFECTS TEST PROGRAM

TENSION AND COMPRESSION MODULI AND RANKS FOR GAGES OF TIMBER PILE No 17
MONOLITH M2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-[illegible]

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[illegible], Phase III, V, I III A

Table. J. 4

Gage No.	E_c (10^3 k/in^2)	E_t (10^3 k/in^2)	Rank
1-1	1.392	1.947	2
1-2	1.935	1.823	5
1-3	1.924	1.822	5
1-4	2.102	1.773	4
1-5	2.049	1.746	5
1-6	1.907	1.800	5
1-7	2.081	1.903	5
2-1	2.056	1.959	4
2-2	1.965	2.006	4
2-3	2.182	2.186	5
2-4	2.227	2.216	5
2-5	2.375	2.108	4
2-6	2.221	2.166	5
2-7	2.232	2.055	5
3-1	1.705	1.740	5
3-2	1.884	1.914	5
3-3	1.988	2.001	5
3-4	2.128	2.050	5
3-5	2.227	2.051	5
3-6	1.610	1.611	5
3-7	2.098	2.034	5
4-1	1.614	1.713	4
4-2	1.959	2.159	4
4-3	1.781	2.254	4
4-4	2.300	2.314	4
4-5	2.290	2.227	4
4-6	2.017	2.037	5
4-7	1.656	1.676	5

Notes:
E_c modulus in compression
E_t modulus in tension

PILE DRIVING EFFECTS TEST PROGRAM

TENSION AND COMPRESSION MODULI AND RANKS FOR GAGES OF TIMBER PILE No 46 MONOLITH M2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-[illegible]

Woodward-Clyde Consultants | Table. J. 5

[illegible], Phase III; Vol III A

Gage No.	E_c (10^3 k/in^2)	E_t (10^3 k/in^2)	Rank
1-1	1.642	1.795	4
1-2	1.525	1.887	5
1-3	1.429	1.881	4
1-4	1.439	1.805	4
1-5	1.430	1.695	4
1-6	1.510	1.786	5
1-7	1.599	1.747	5
2-1	1.769	1.520	5
2-2	1.635	1.562	5
2-3	1.596	1.619	5
2-4	1.627	1.589	5
2-5	1.430	1.450	4
2-6	1.652	1.549	5
2-7	1.744	1.524	5
3-1	1.768	1.648	5
3-2	4.494	4.007	4
3-3	3.010	2.937	4
3-4	2.934	2.984	3
3-5	2.038	1.611	5
3-6	1.728	1.483	4
3-7	1.703	1.533	5
4-1	1.500	1.716	4
4-2	–	–	2
4-3	1.632	1.615	5
4-4	1.663	1.731	5
4-5	1.855	1.639	5
4-6	1.590	1.710	5
4-7	1.733	1.851	5

Notes:

E_c modulus in compression

E_t modulus in tension

PILE DRIVING EFFECTS TEST PROGRAM

TENSION AND COMPRESSION MODULI AND RANKS FOR GAGES OF TIMBER PILE No. 8 MONOLITH M2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
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[illegible], Phase III, Vol III A

Table. J.6

Gage No.	E_c (10^3 k/in²)	E_t (10^3 k/in²)	Rank
1-1	1.810	1.513	5
1-2	1.857	1.615	5
1-3	1.993	1.745	5
1-4	2.219	1.628	5
1-5	2.258	1.469	4
1-6	1.641	1.380	4
1-7	2.259	2.156	4
2-1	1.644	1.876	5
2-2	1.748	1.907	5
2-3	1.542	1.718	5
2-4	1.353	1.427	4
2-5	1.592	1.501	5
2-6	1.487	1.685	4
2-7	2.042	2.085	5
3-1	1.671	1.822	5
3-2	1.524	2.038	5
3-3	1.878	1.911	5
3-4	1.497	1.529	4
3-5	1.352	1.141	4
3-6	1.645	1.572	5
3-7	1.617	1.511	5
4-1	2.076	1.792	5
4-2	1.206	1.057	4
4-3	2.090	1.787	5
4-4	2.110	1.739	4
4-5	1.866	1.469	4
4-6	1.776	1.632	5
4-7	2.070	1.818	4

Notes:
E_c modulus in compression
E_t modulus in tension

PILE DRIVING EFFECTS TEST PROGRAM

TENSION AND COMPRESSION MODULI AND RANKS FOR GAGES OF TIMBER PILE No 20
MONOLITH M2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
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[illegible], Phase III ; Vol IIIA

Gage No.	E_c ($10^3 \cdot k/in^2$)	E_t ($10^3 \cdot k/in^2$)	Rank
1-1	1.665	1.838	5
1-2	1.880	2.139	5
1-3	1.775	2.103	5
1-4	1.294	1.862	4
1-5	2.144	2.013	5
1-6	2.147	2.363	5
1-7	1.532	1.779	5
2-1	1.853	1.692	5
2-2	1.738	1.762	5
2-3	1.743	1.852	5
2-4	1.633	1.328	4
2-5	1.872	1.708	5
2-6	1.858	1.816	5
2-7	1.786	1.825	5
3-1	1.837	1.668	5
3-2	1.722	1.618	5
3-3	1.966	1.675	5
3-4	1.793	1.602	5
3-5	2.342	1.854	5
3-6	2.058	1.709	4
3-7	2.013	1.656	4
4-1	1.731	1.977	5
4-2	1.649	1.834	5
4-3	1.819	2.041	5
4-4	1.976	2.098	5
4-5	2.138	2.041	5
4-6	1.890	2.045	5
4-7	2.002	2.153	5

Notes:

E_c: modulus in compression

E_t: modulus in tension

PILE DRIVING EFFECTS TEST PROGRAM

TENSION AND COMPRESSION MODULI AND RANKS FOR GAGES OF TIMBER PILE No 10 MONOLITH M2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. [illegible]
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[illegible], Phase II; Vol III A

Table. J.8

PHASE IV REPORT

VOLUME IIIA

RESULTS AND INTERPRETATION OF
PILE DRIVING EFFECTS TEST PROGRAM

APPENDIX K

TEST AREA SUBSURFACE CONDITIONS

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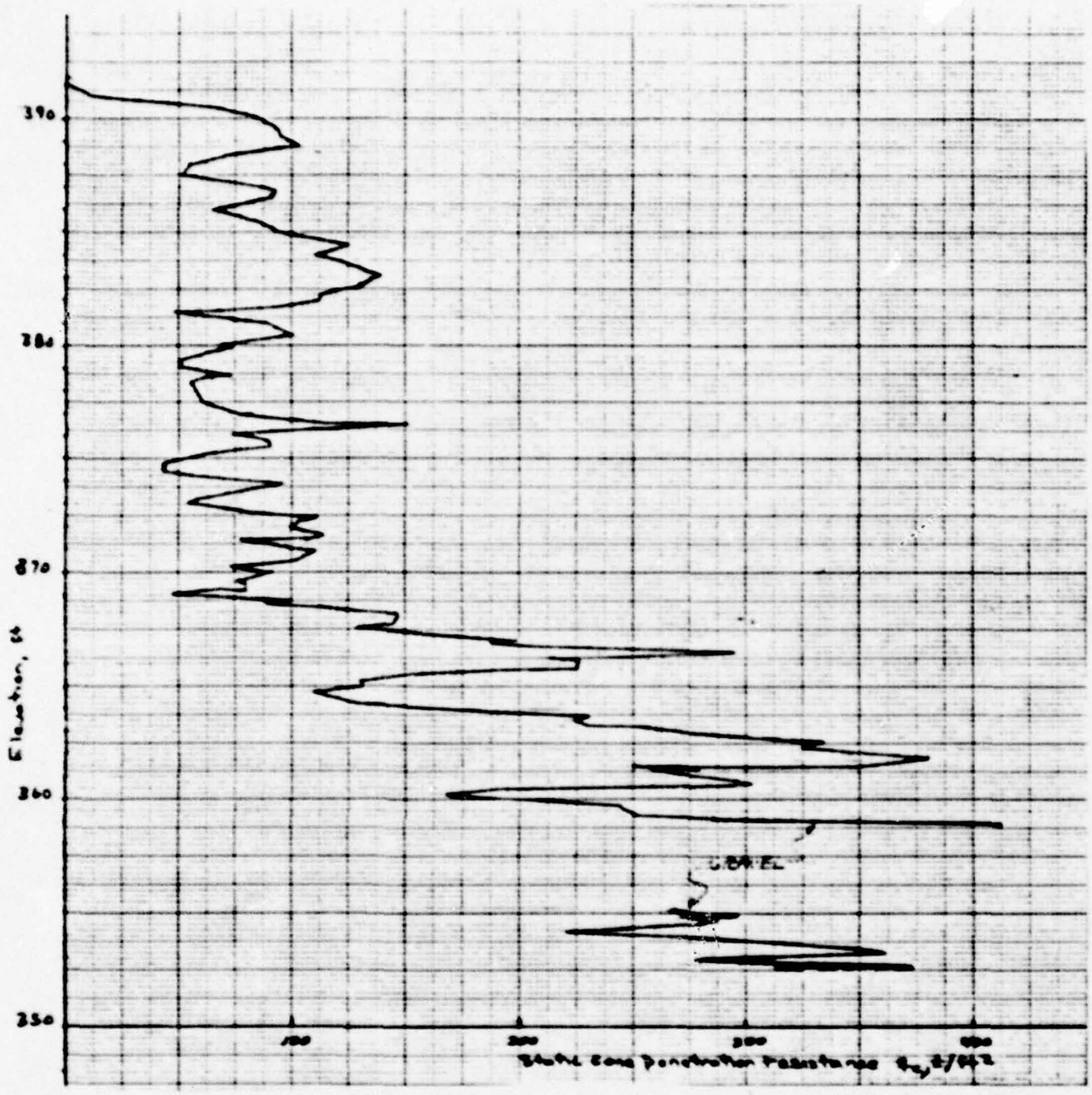

Boring PD-C2

PILE DRIVING EFFECTS TEST PROGRAM

STATIC CONE PENETRATION RESISTANCE RESULTS

BEFORE TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0000

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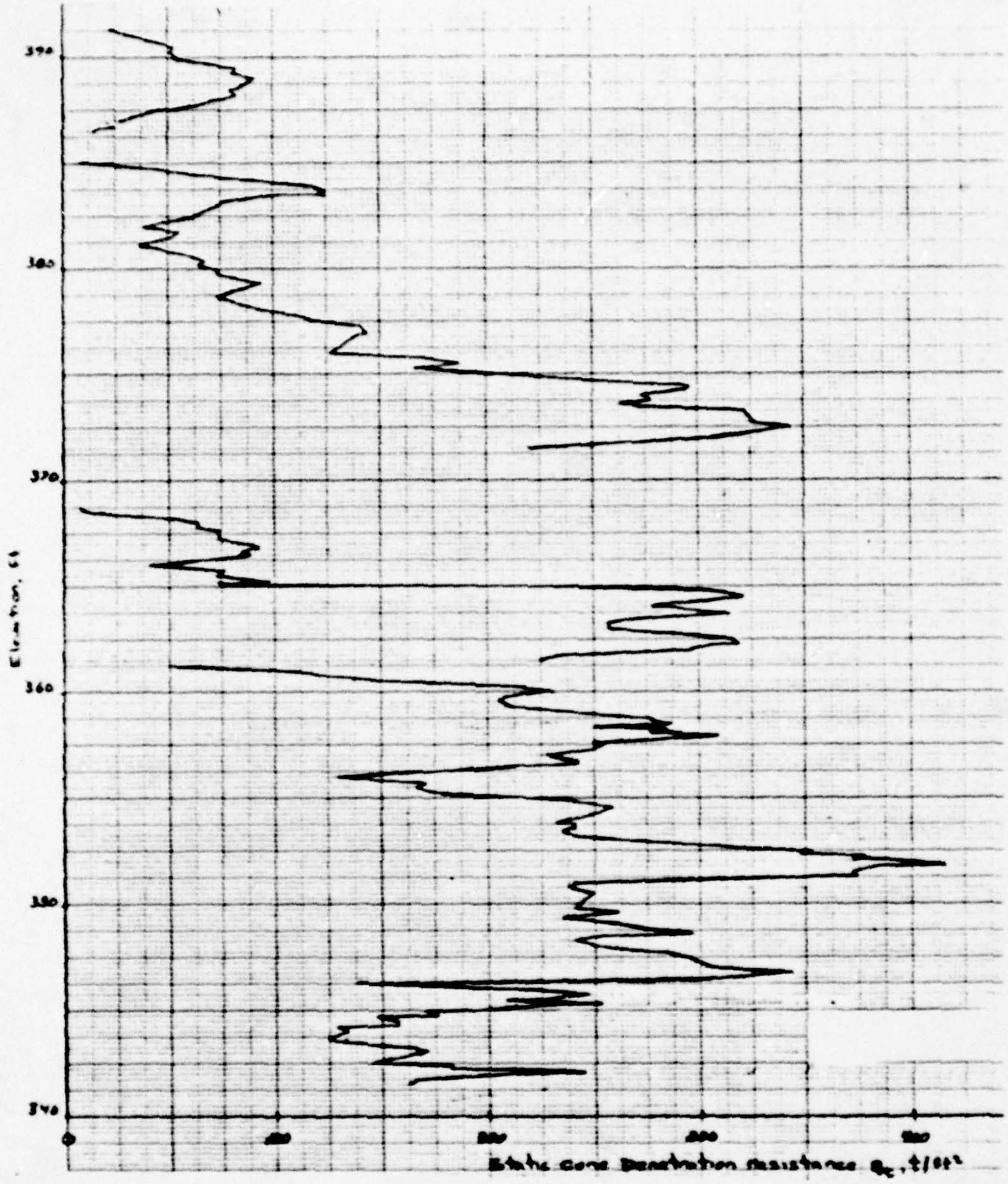
77C020, Phase III, Vol IIA

Fig. K.1



Boring PD-C5

PILE DRIVING EFFECTS TEST PROGRAM

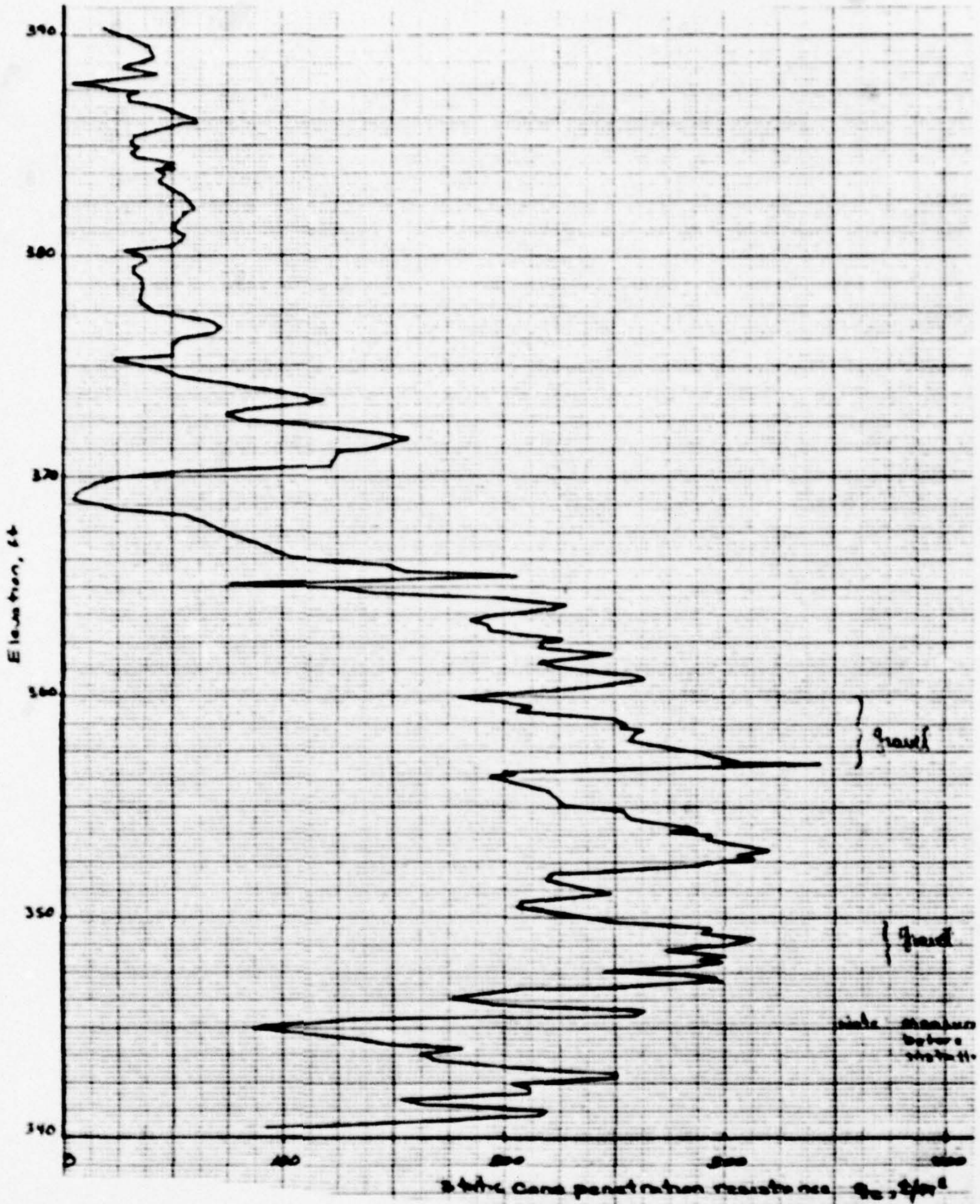
STATIC CONE PENETRATION RESISTANCE RESULTS

BEFORE TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0000

Woodward-Clyde Consultants | Fig. K.2

Y7C020, Phase II; Vol IIIA



Boring PD-C6

PILE DRIVING EFFECTS TEST PROGRAM

STATIC CONE PENETRATION RESISTANCE RESULTS

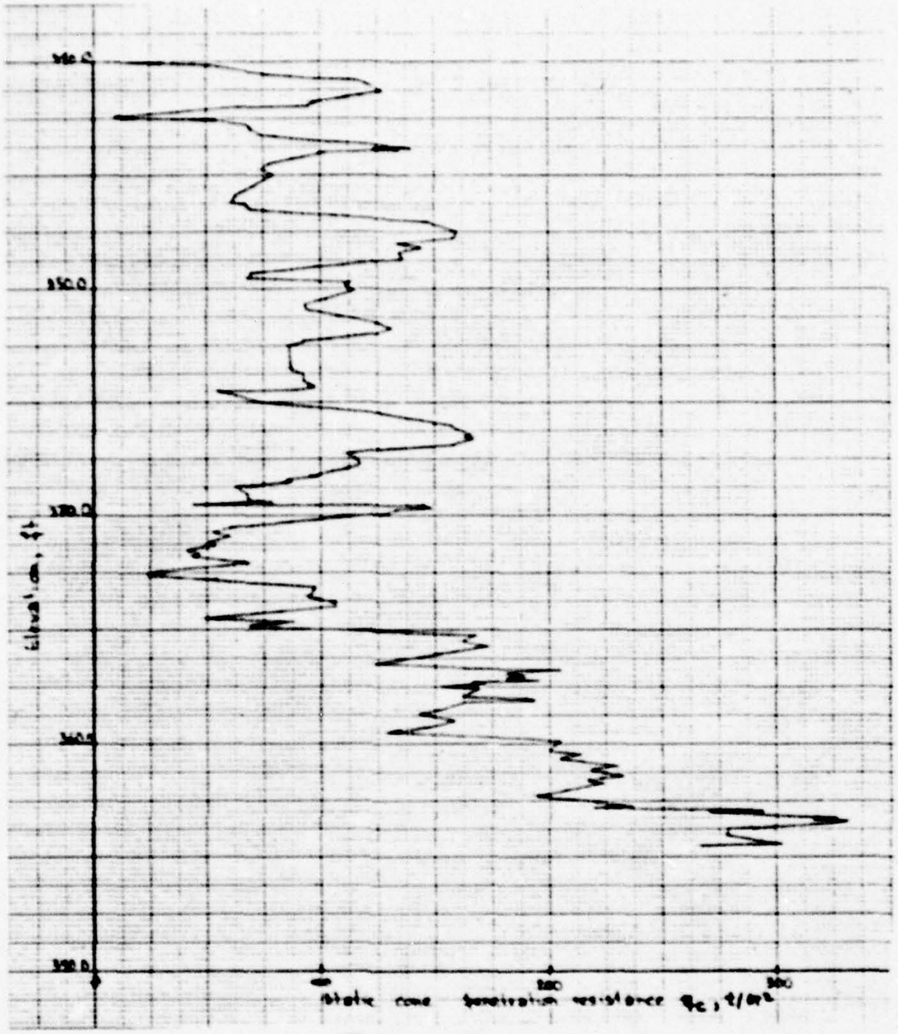
BEFORE TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0095

Woodward-Clyde Consultants

77C020, Phase III; Vol III A

Fig. K.3



Boring PD-CB

PILE DRIVING EFFECTS TEST PROGRAM

STATIC CONE PENETRATION RESISTANCE RESULTS

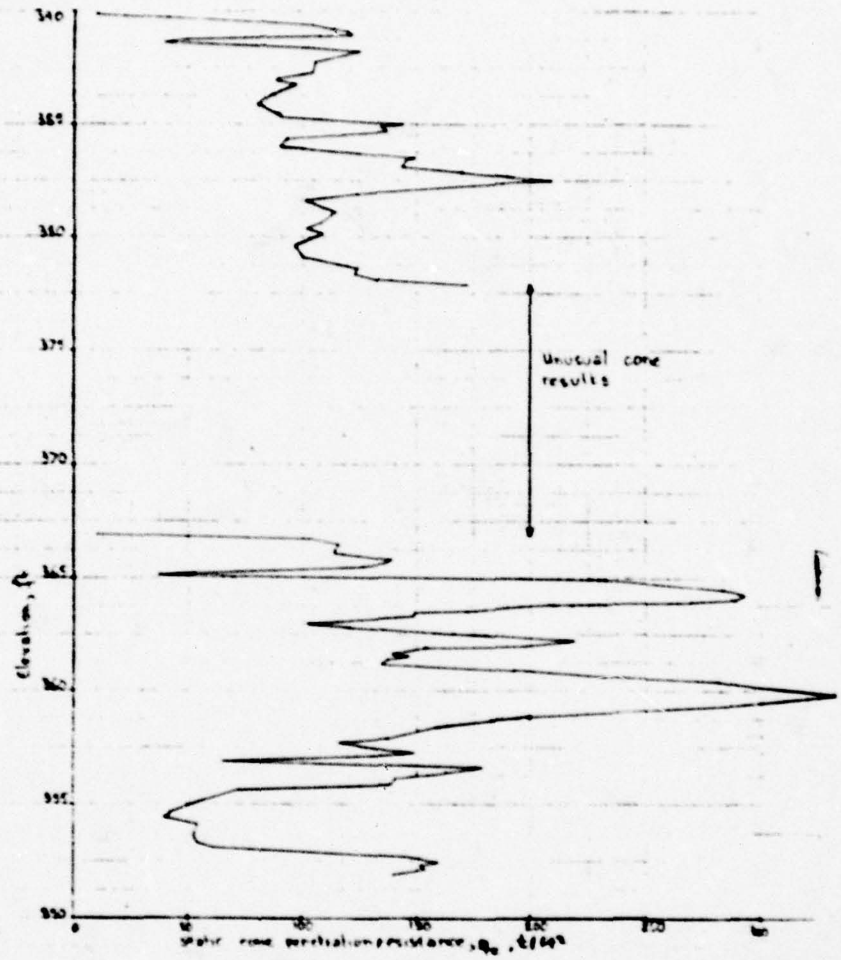
BEFORE TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0000

Woodward-Clyde Consultants

Y7C026, Phase III: Vol IIIA

Fig. K.4



Boring PD-C9

PILE DRIVING EFFECTS TEST PROGRAM

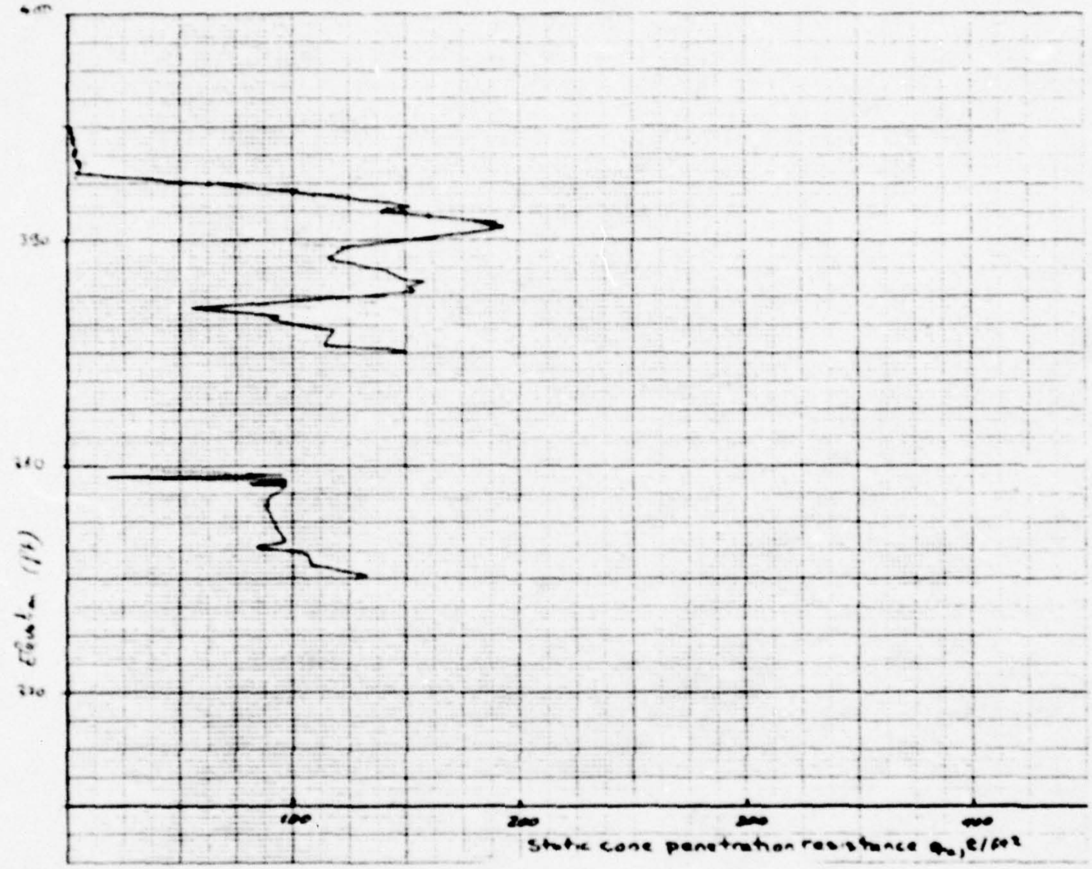
STATIC CONE PENETRATION RESISTANCE RESULTS

BEFORE TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-7[illegible]-C-[illegible]

Woodward-Clyde Consultants
77C0[illegible], Phase III, Vol IIIA

Fig. K.5



Boring PD-C11

PILE DRIVING EFFECTS TEST PROGRAM

STATIC CONE PENETRATION RESISTANCE RESULTS

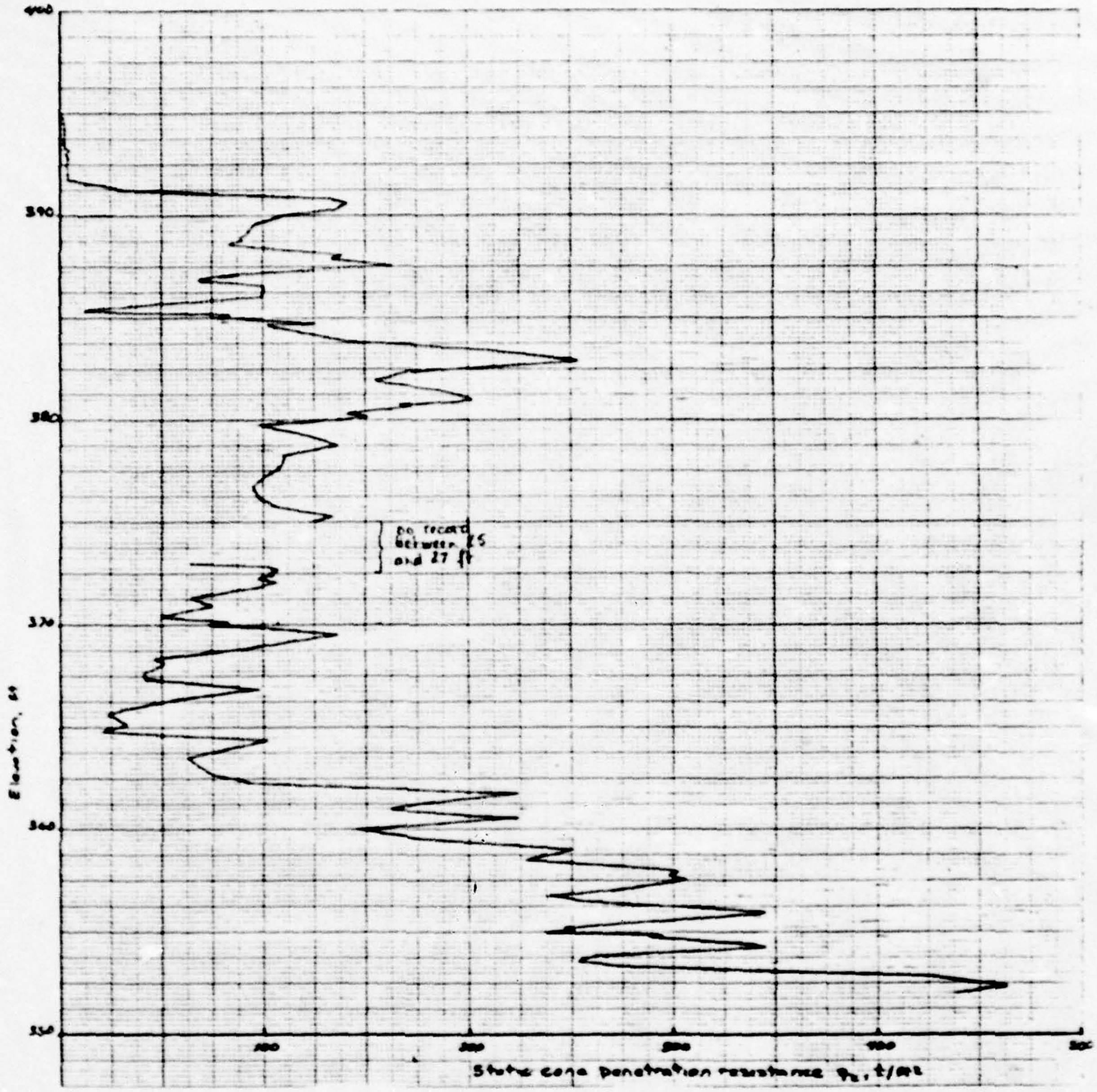
BEFORE TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

ST C026, Phase III, Vol III A

Fig. K.6



Boring PD-C14

PILE DRIVING EFFECTS TEST PROGRAM

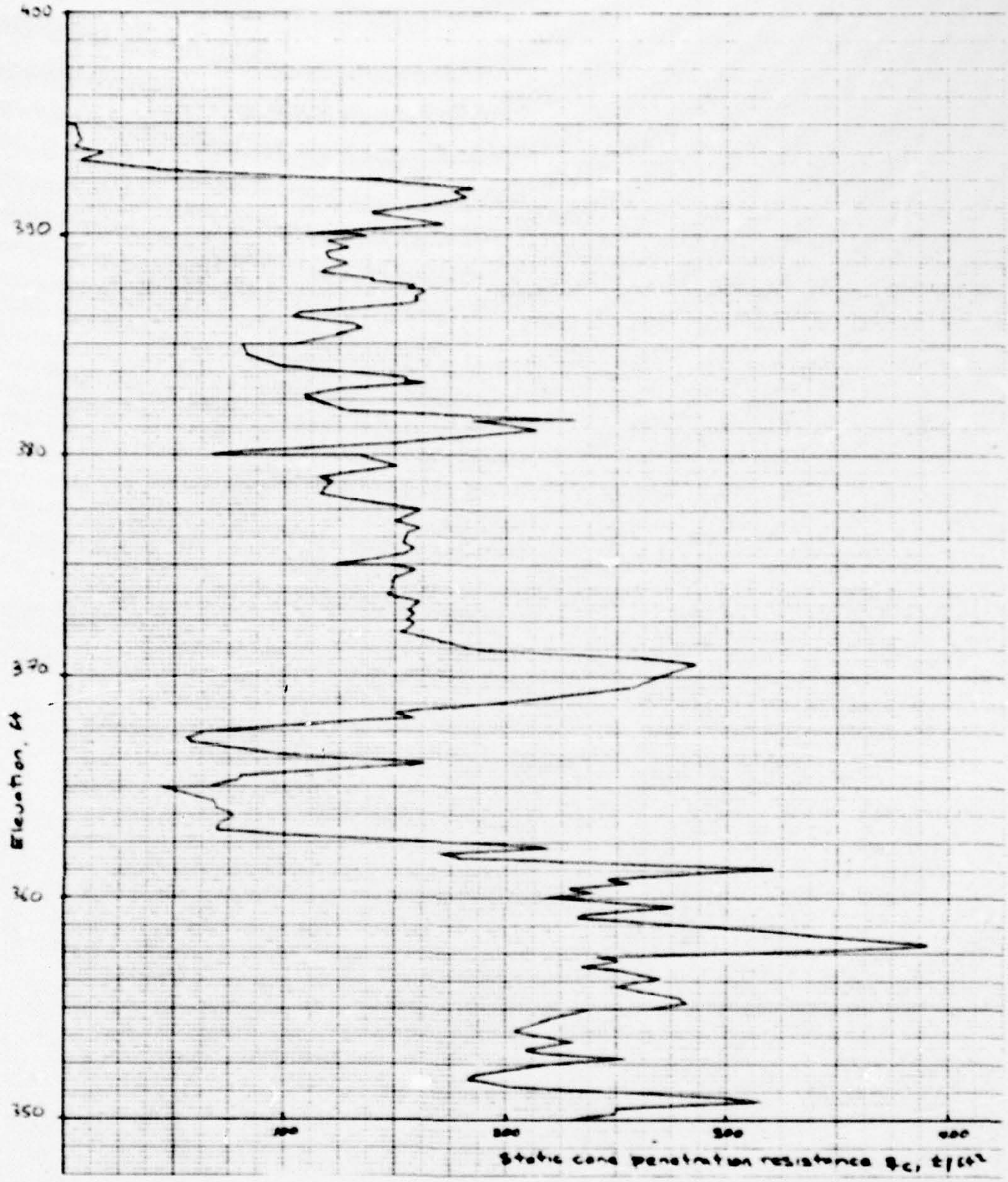
STATIC CONE PENETRATION RESISTANCE RESULTS

BEFORE TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-7[illegible]

Woodward-Clyde Consultants
77C028, Phase III, Vol III A

Fig. K.7



Boring PD-C15

PILE DRIVING EFFECTS TEST PROGRAM

STATIC CONE PENETRATION RESISTANCE RESULTS

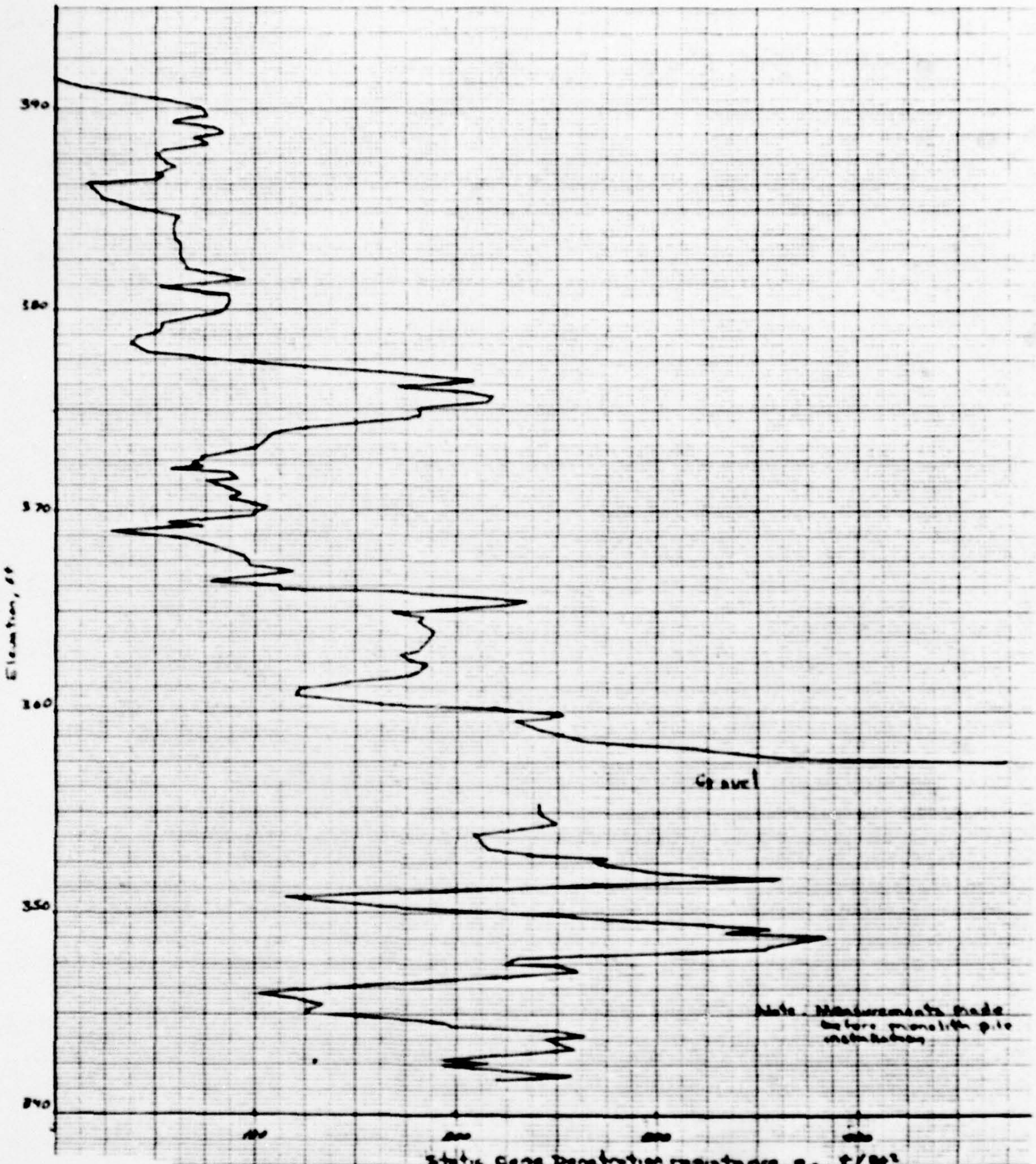
BEFORE TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0000

Woodward-Clyde Consultants

Fig. K.8

Y7C029, Phase III, Vol IIIA



BORING PD-C23

PILE DRIVING EFFECTS TEST PROGRAM

STATIC CONE PENETRATION RESISTANCE RESULTS

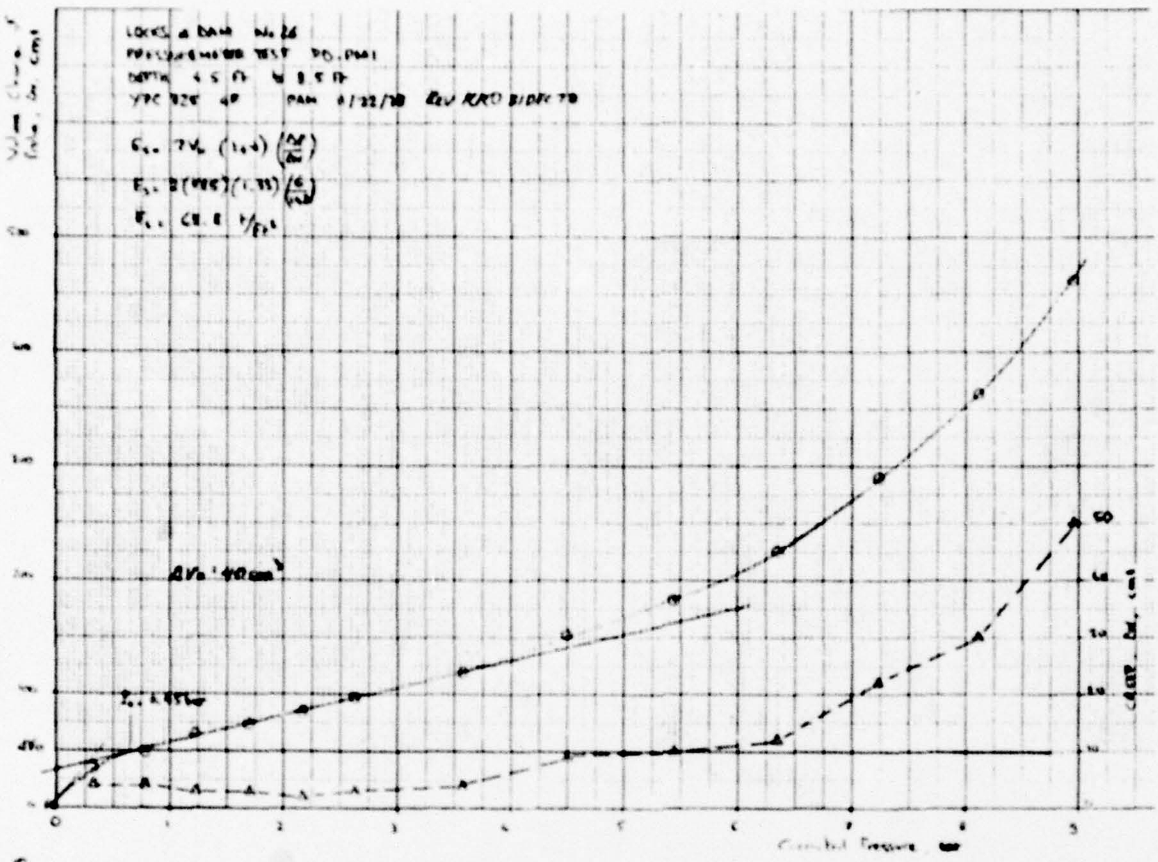
BEFORE TIMBER PILE INSTALLATION

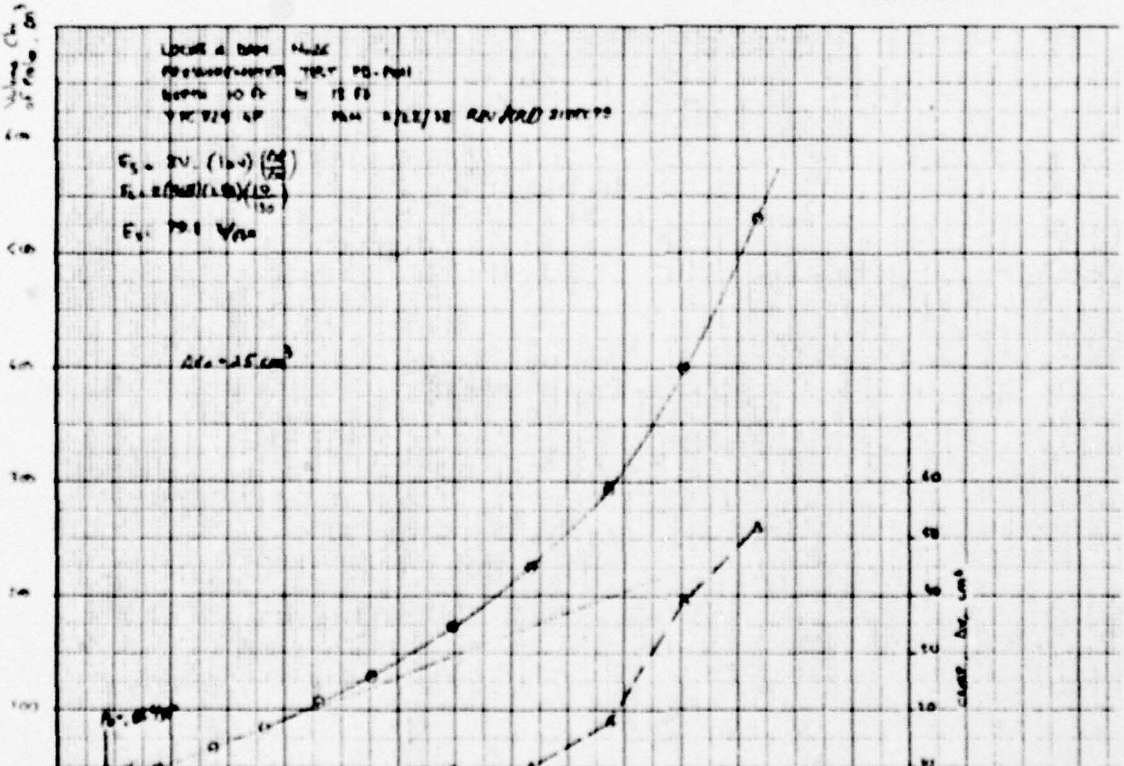
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Y?C023, Phase II, Vol IIIA

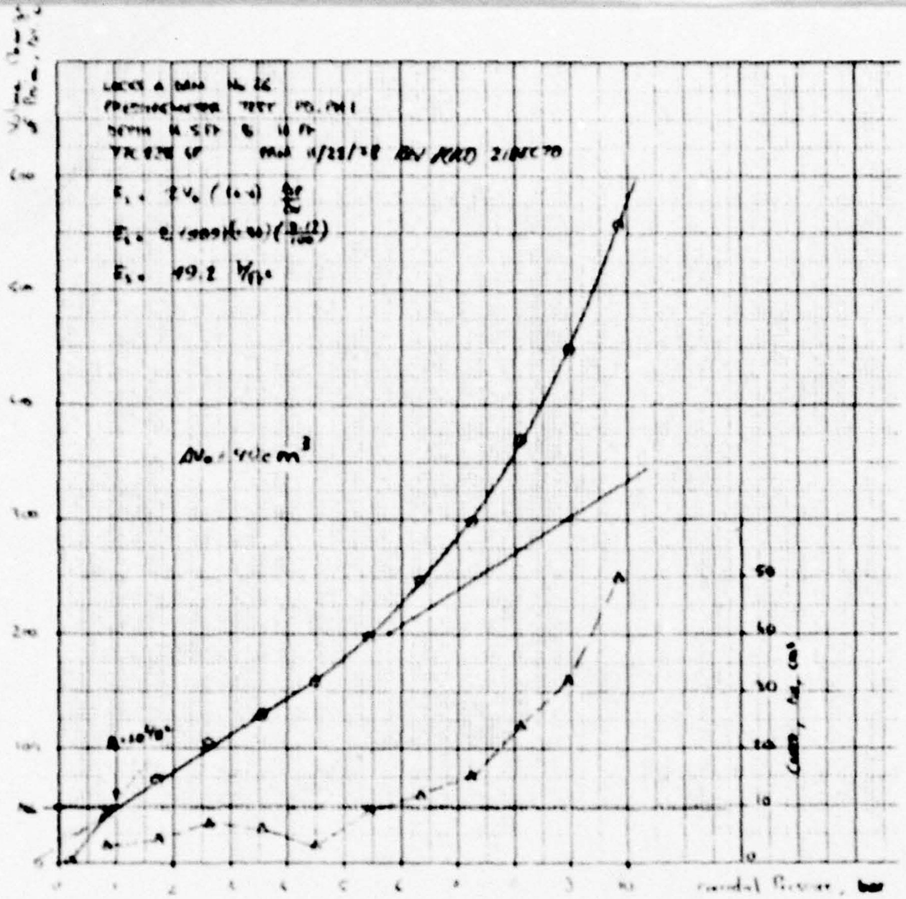
Fig. K.9





Le
-●- Probe correc
-▲- Creep pressu
P_o In situ
E_s Elastic modul

1



Legend

- ● Probe volume change versus corrected pressure
- ▲ Creep versus corrected pressure

P_o In situ horizontal stress

E_s Elastic deformation modulus

PILE DRIVING EFFECTS TEST PROGRAM

PRESSUREMETER TEST RESULTS BEFORE TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0000

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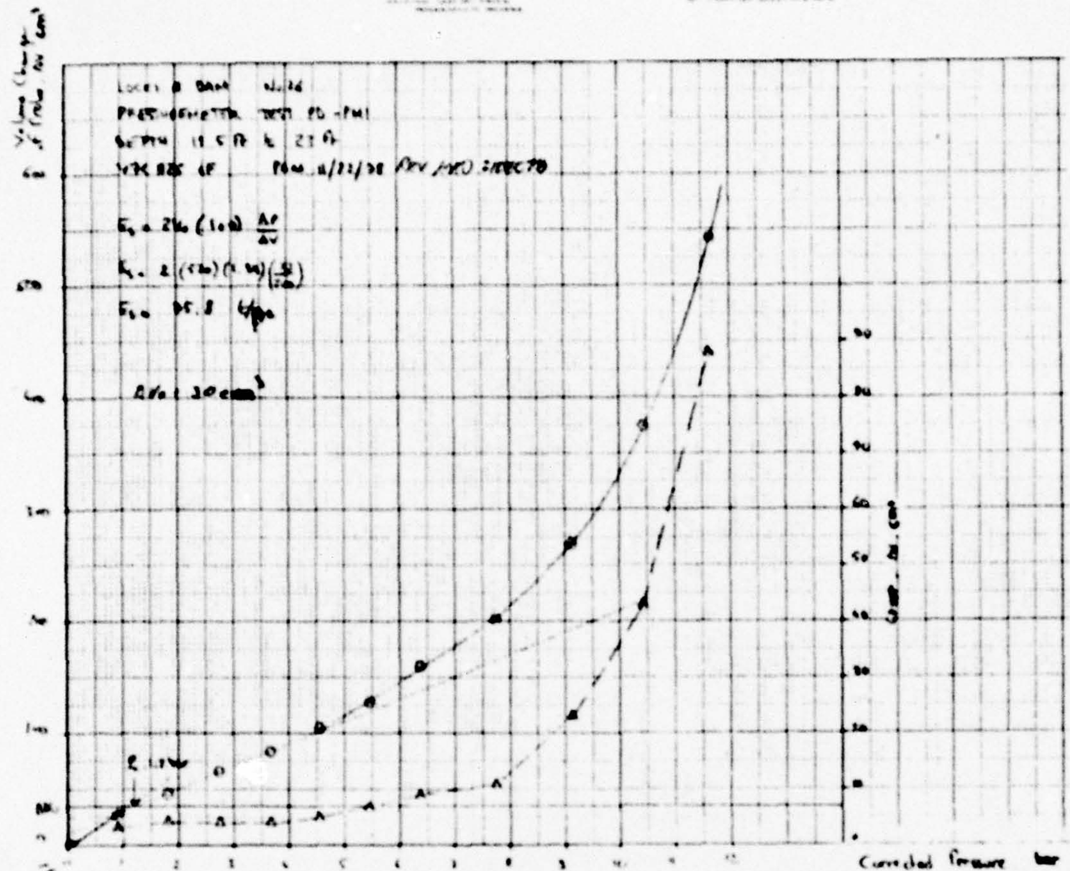
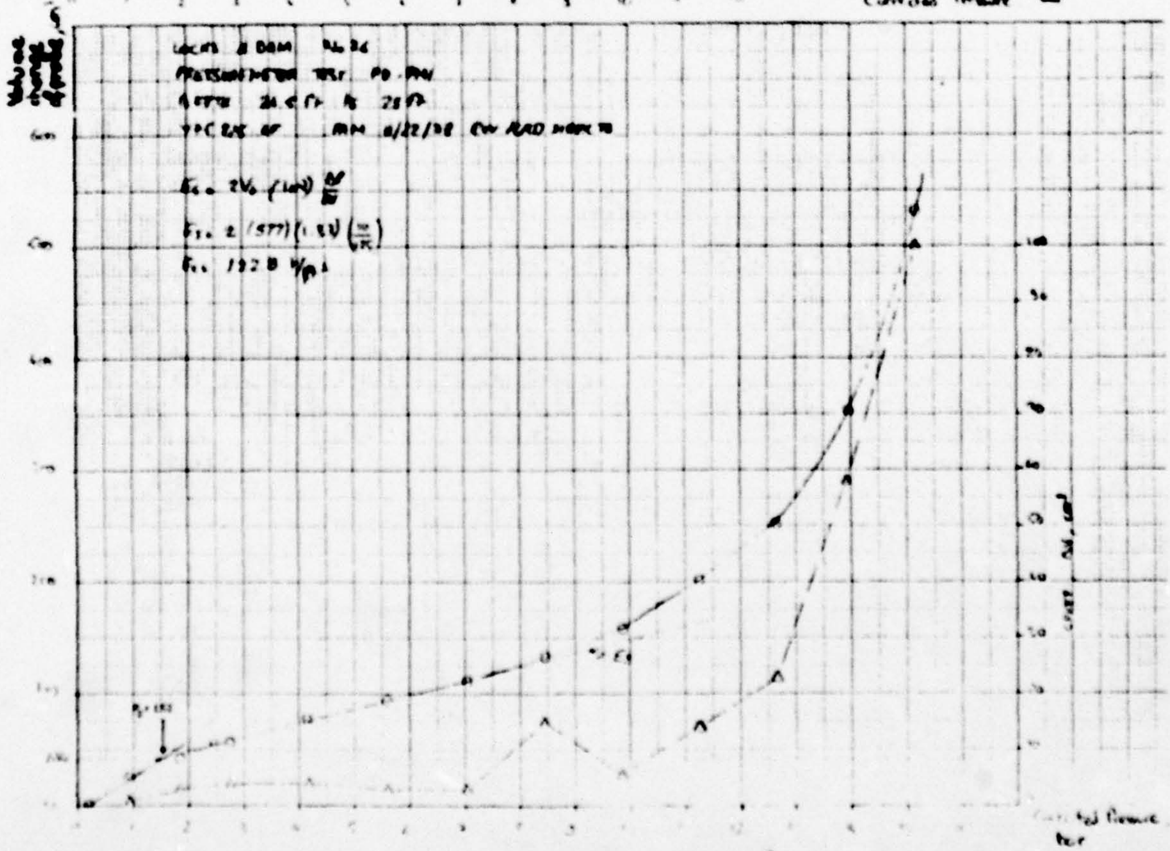
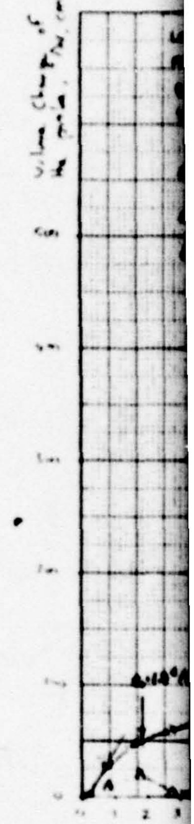
Fig. K.10

1 2







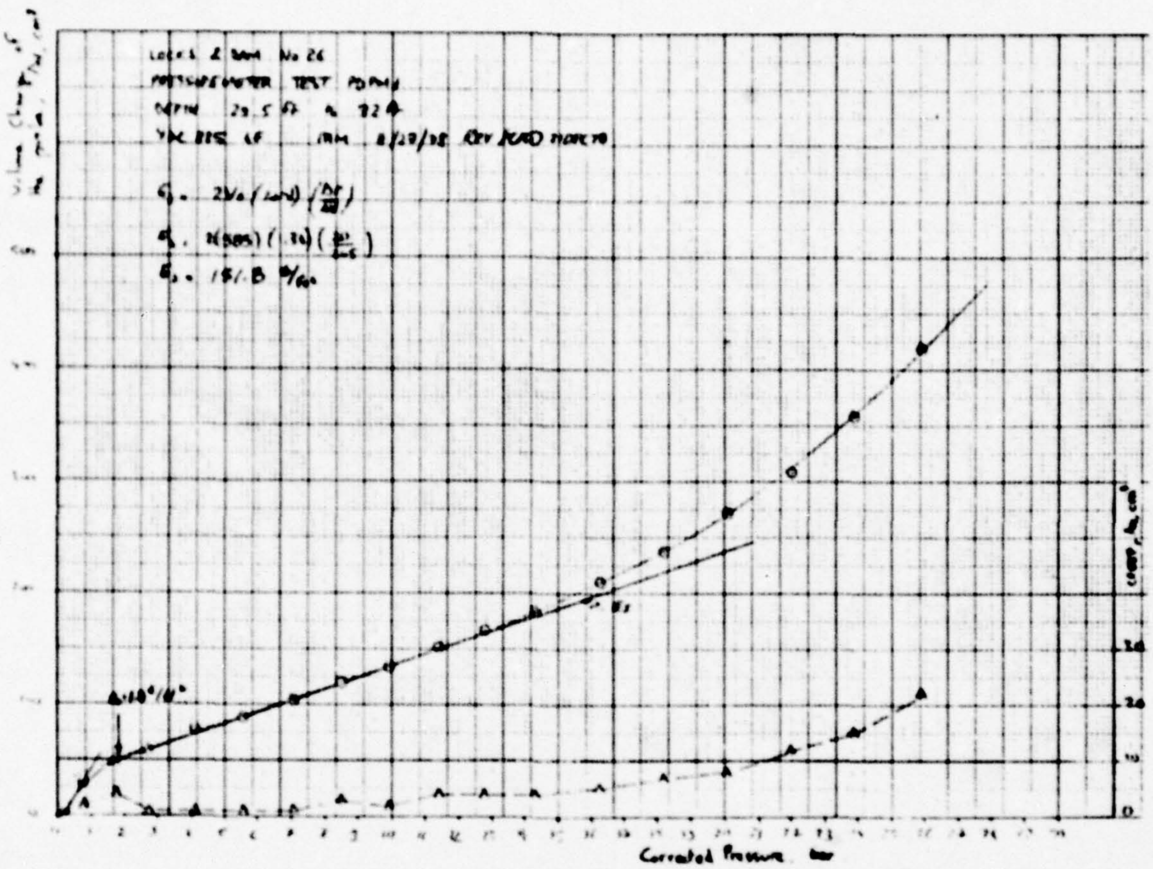
L

-o- Probe
corre

-▲- Creep
press

P_o In sit

E_s Elastic
modu



Legend

- -o- *Probe volume change versus corrected pressure*
- -△- *Creep versus corrected pressure*
- P_o *In situ horizontal stress*
- E_s *Elastic deformation modulus*

PILE DRIVING EFFECTS TEST PROGRAM

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FOUNDATION INVESTIGATION AND TEST PROGRAM
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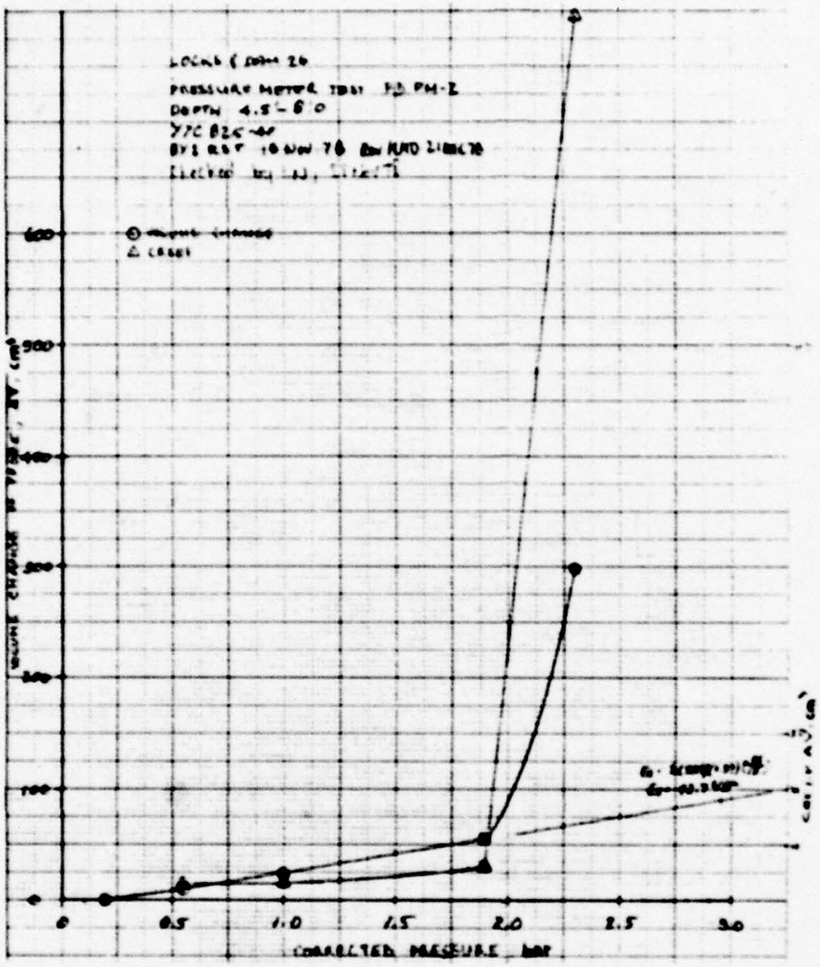
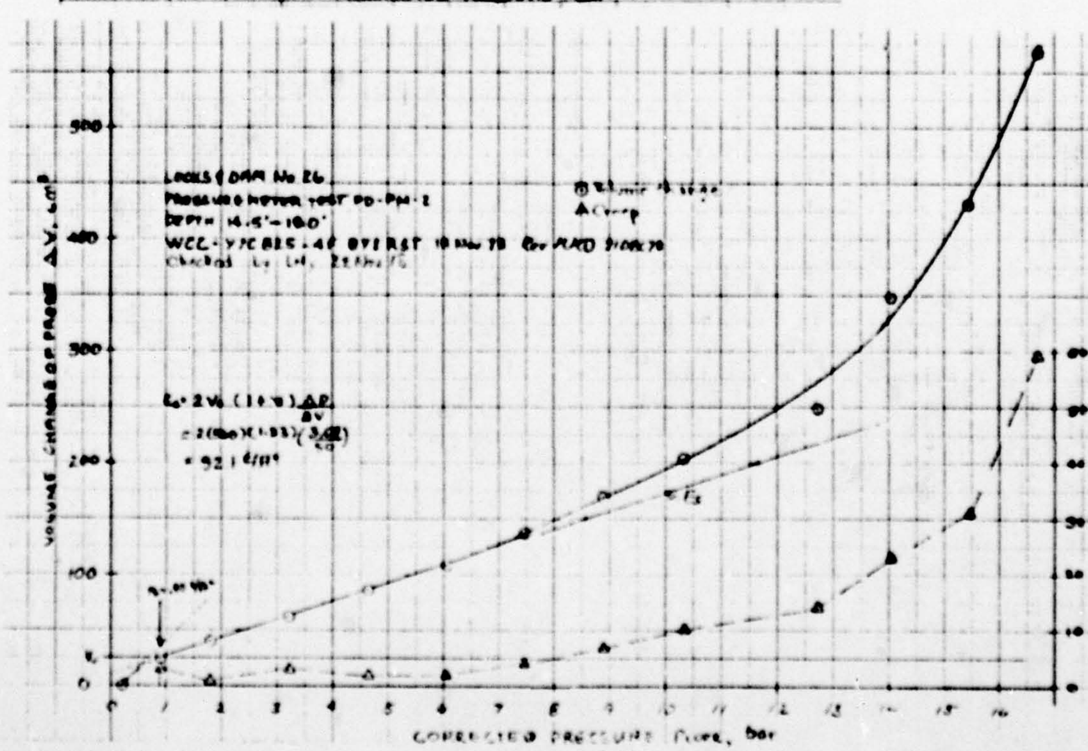
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

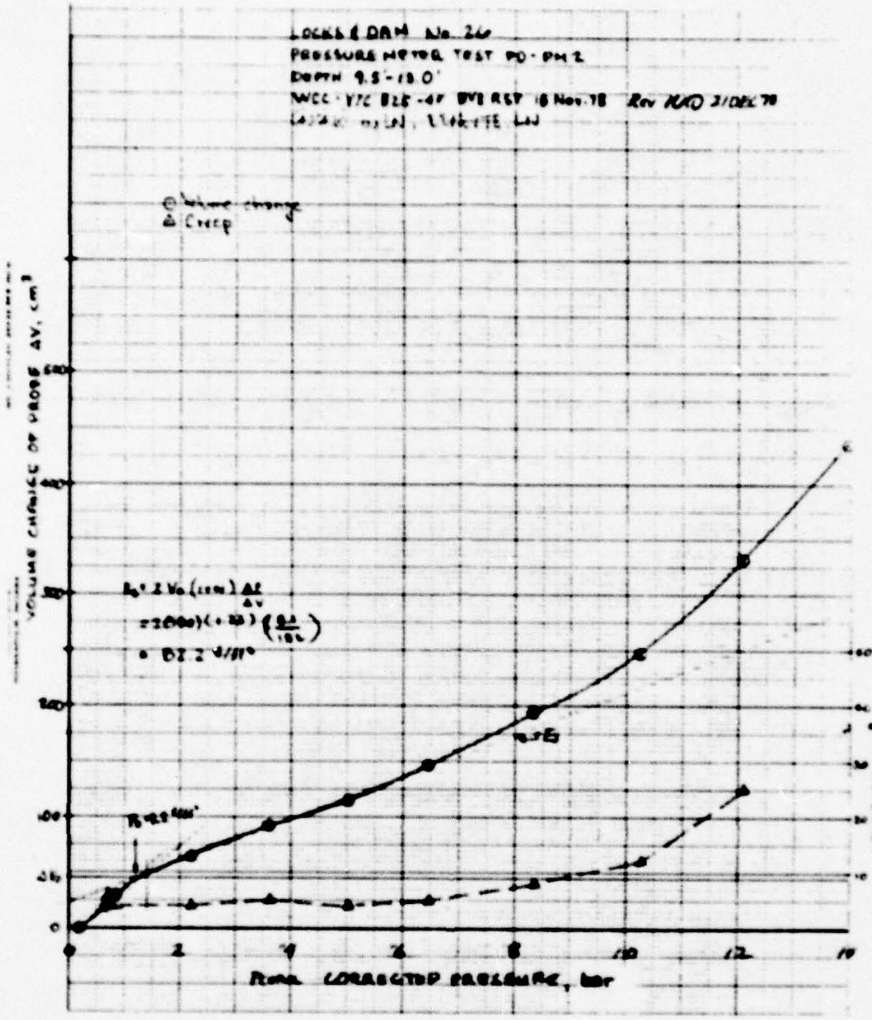
Woodward-Clyde Consultants
YYC025, Phase III, Vol III A

Fig. K.11

1 2


LOCKS & DAM 26
PRESSUREMETER TEST PD-PM-2
DEPTH 4.5'-6.0
CORRECTED PRESSURE, bar


LOCKS & DAM No 26
PRESSUREMETER TEST PD-PM-2
DEPTH 14.5'-16.0'
VOLUME CHANGE OF PROBE ΔV, cm³
CREEP ΔV, cm³
CORRECTED PRESSURE P, bar



Legend

- Probe volume change versus corrected pressure
- Creep versus corrected pressure

P_o In situ horizontal stress

E_s Elastic deformation modulus

PILE DRIVING EFFECTS TEST PROGRAM

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EXISTING LOCKS AND DAM No. 26
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DACW43-78-C-0095

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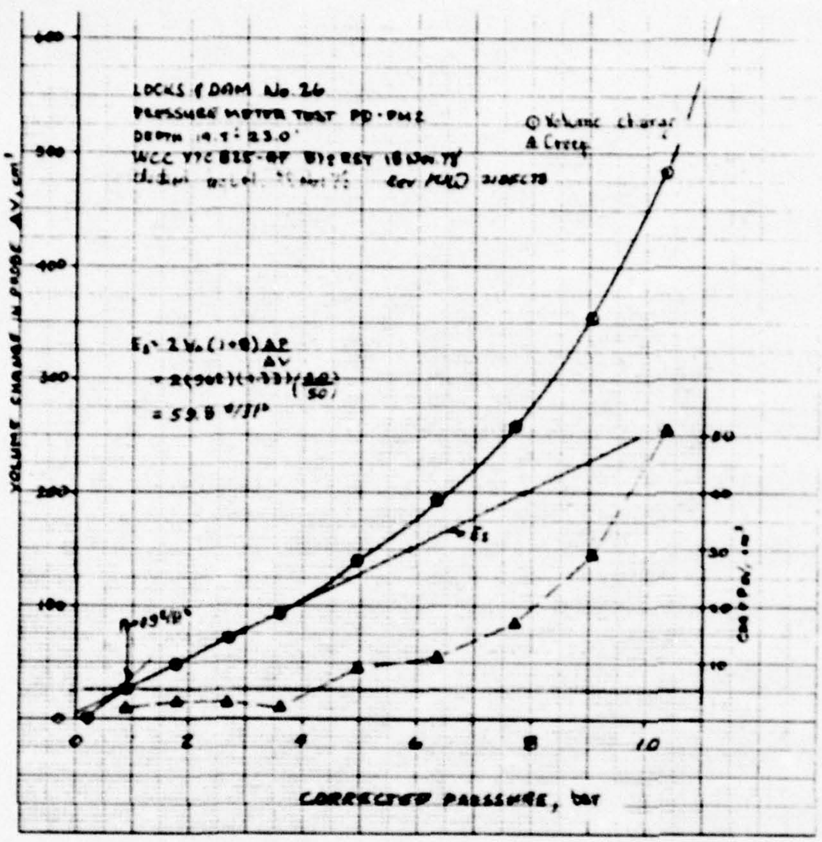
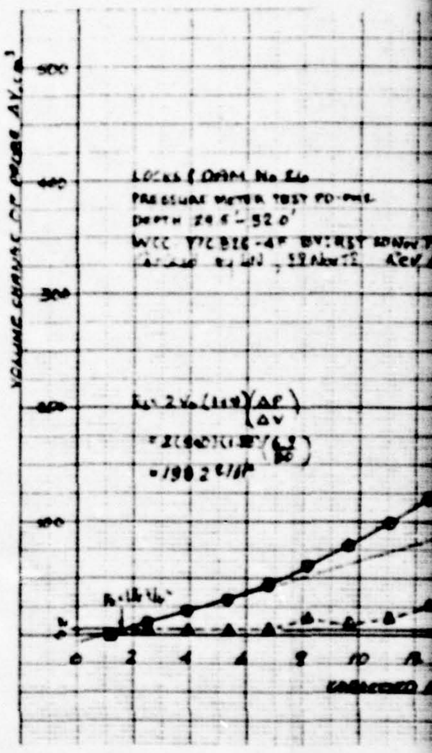
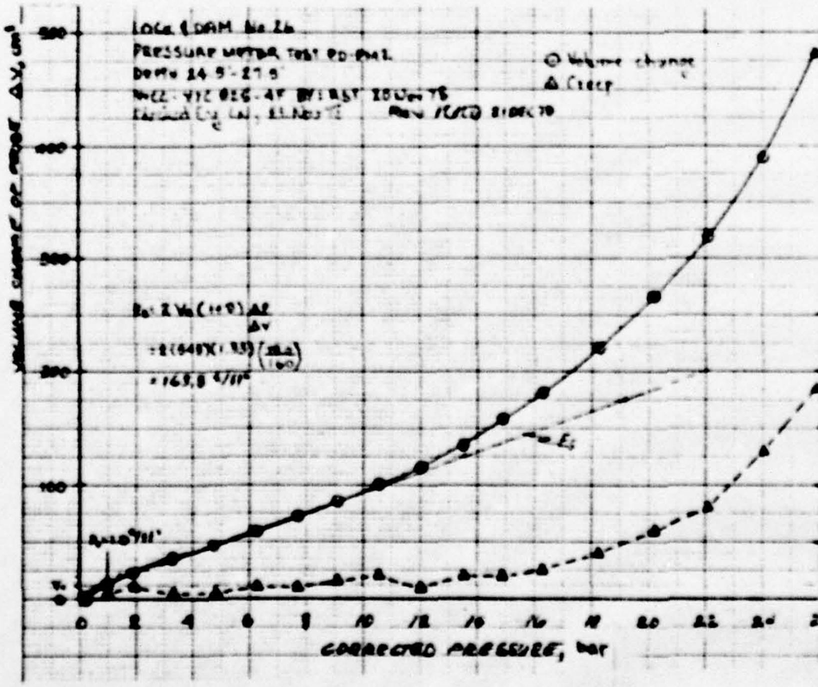
Y7C025, Phase III, Vol IIIA

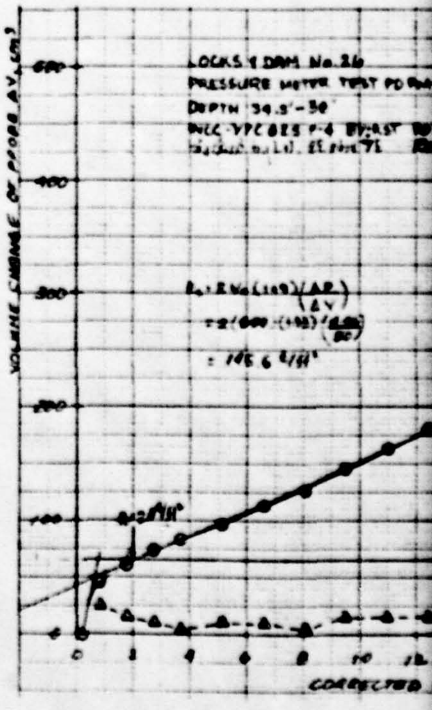
Fig. K.12

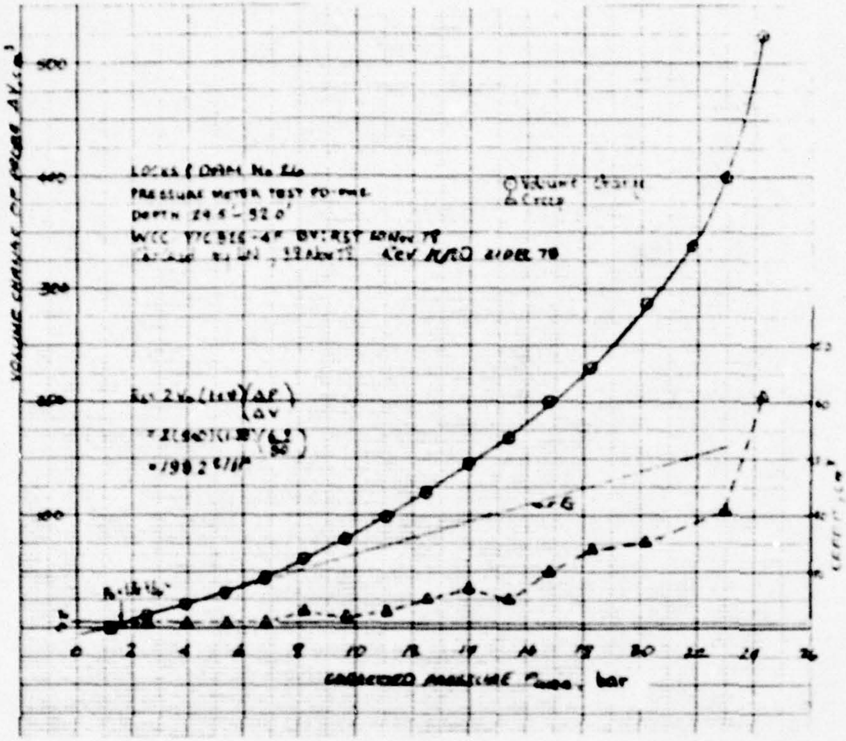
1 2

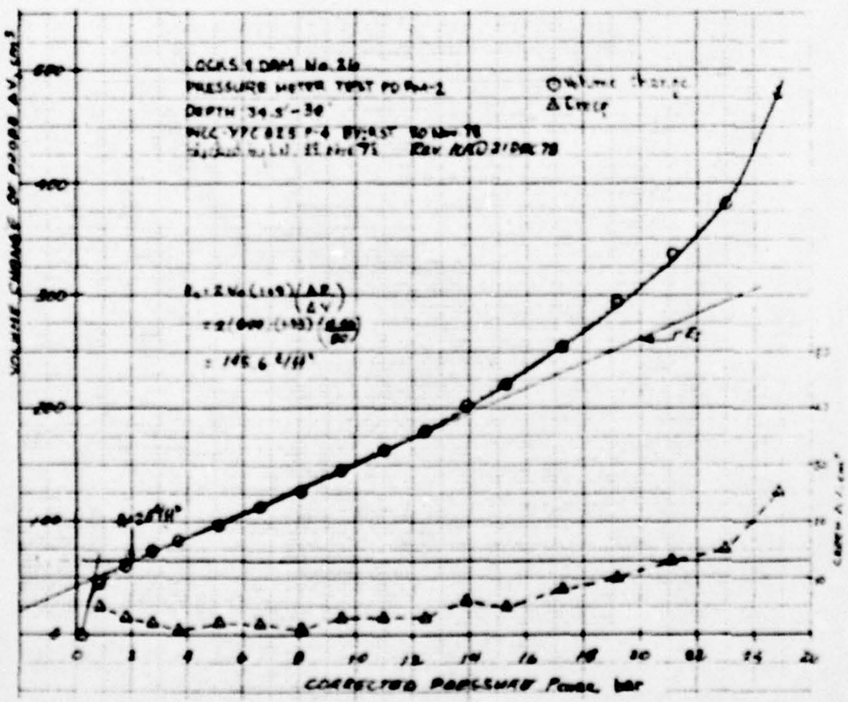

LOCKS & DAM No. 26
PRESSURE METER TEST PD-PM2
Volume change
Creep
VOLUME CHANGE IN PROBE ΔV, cm³
CORRECTED PRESSURE, bar
E_s


LOCKS & DAM No. 26
PRESSURE METER TEST PD-PM2


LOCKS & DAM No. 26
PRESSURE METER TEST PD-PM2
Volume change
Creep
VOLUME CHANGE OF PROBE ΔV, cm³
CORRECTED PRESSURE, bar
E_s


LOCKS & DAM No. 26
PRESSURE METER TEST
CORRECTED





Legend

- -●- Probe volume change versus corrected pressure
- -▲- Creep versus corrected pressure
- P_o In situ horizontal stress
- E_s Elastic deformation modulus

PILE DRIVING EFFECTS TEST PROGRAM

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FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0092

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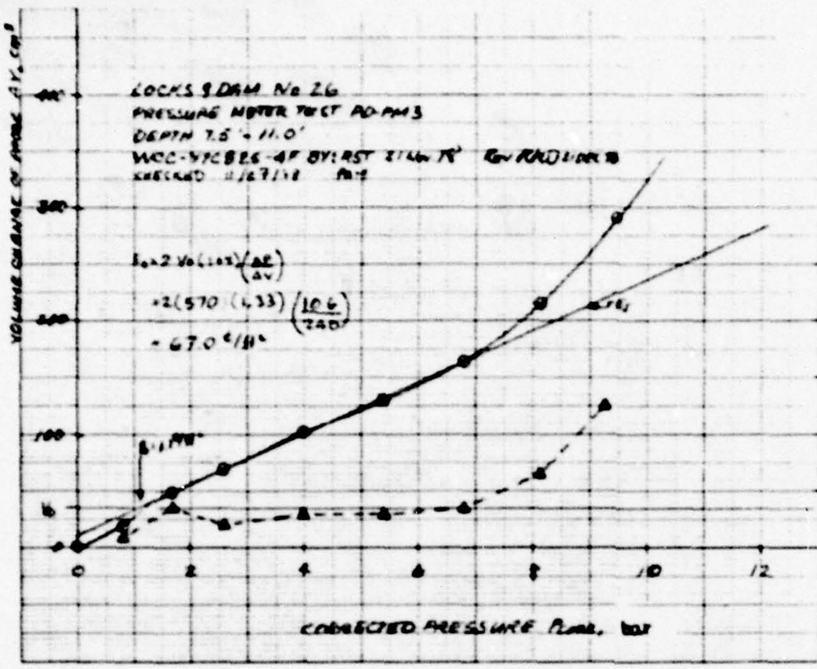
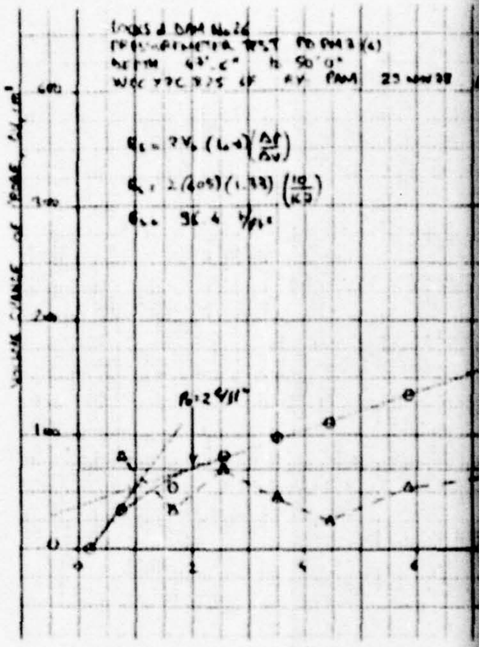
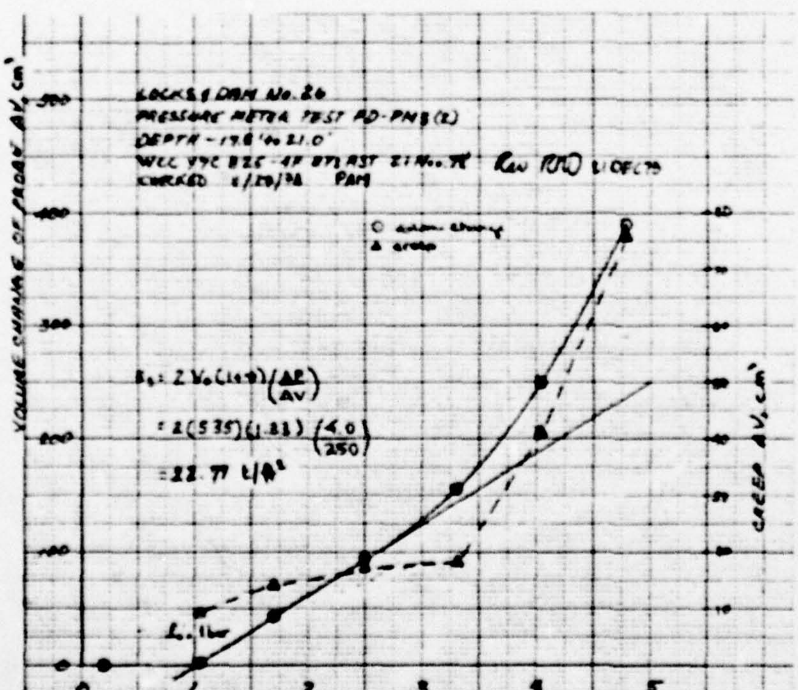
Y7C026 Phase III Vol IIIA

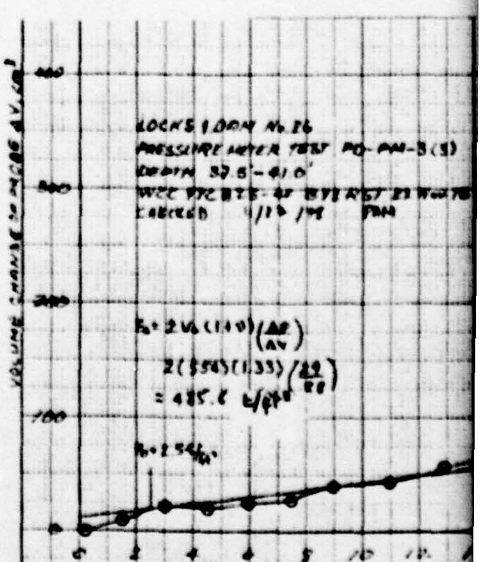
Fig. K.13

2

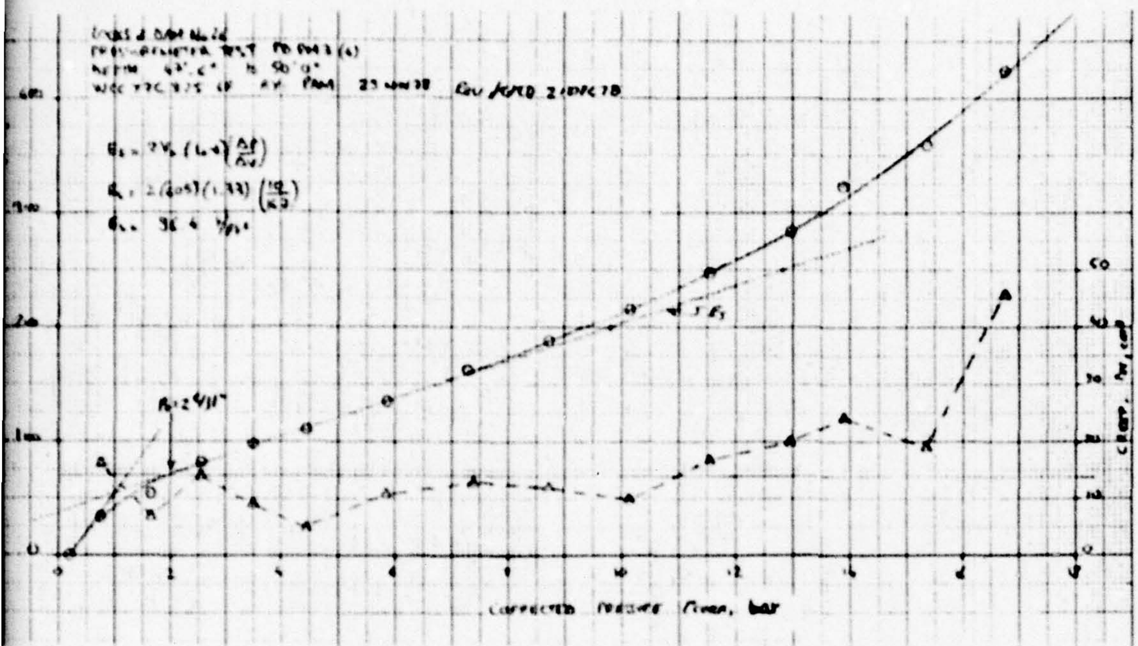

LOCKS & DAM No. 26
PRESSURE METER TEST PD-PM3
DEPTH 7.5' - 11.0'
CORRECTED PRESSURE P_{corr}, bar
VOLUME CHANGE OF PROBE ΔV, cm^3


LOCKS & DAM No. 26


LOCKS & DAM No. 26
PRESSURE METER TEST PD-PM3(2)
CORRECTED PRESSURE, bar
VOLUME CHANGE OF PROBE ΔV, cm^3
CREEP ΔV, cm^3

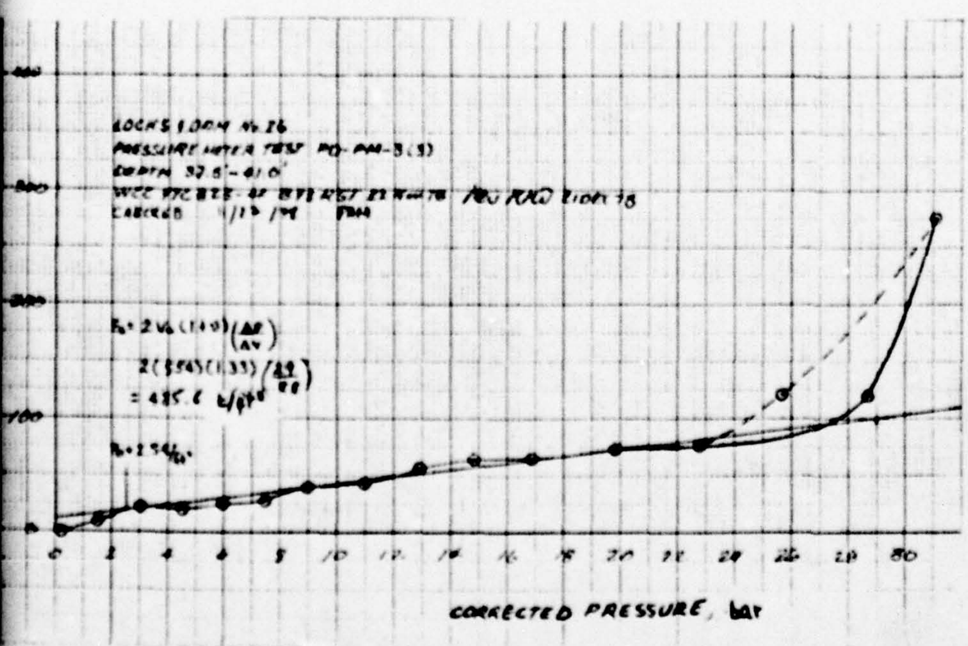

LOCKS & DAM No. 26
PRESSURE METER TEST PD-PM-3(3)
DEPTH 37.5' - 41.0'

1



Legend

- -o- *Probe volume change versus corrected pressure*
- -▲- *Creep versus corrected pressure*
- P_o *In situ horizontal stress*
- E_s *Elastic deformation modulus*



PILE DRIVING EFFECTS TEST PROGRAM

PRESSUREMETER TEST RESULTS

BEFORE TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

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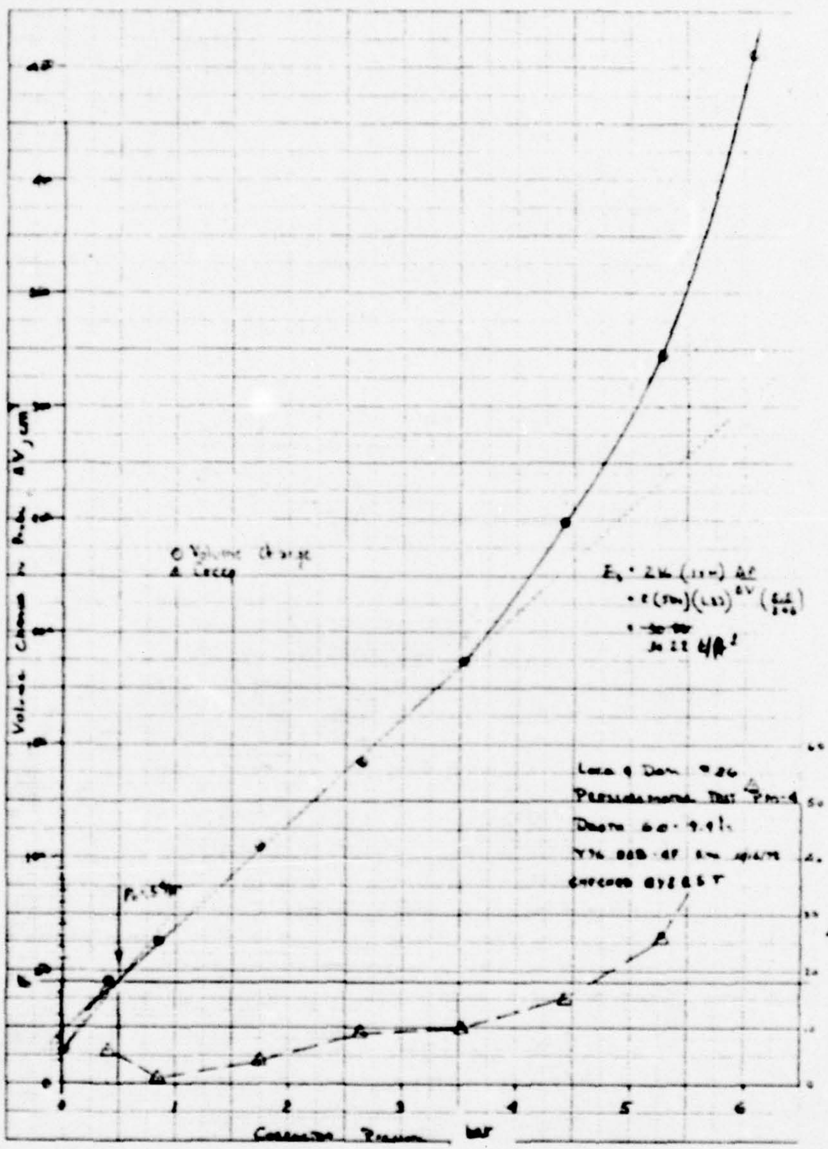
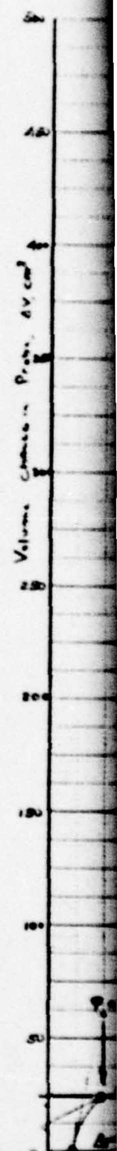
77C0325 Phase III, Vol IIA

Fig. K.14

1 2





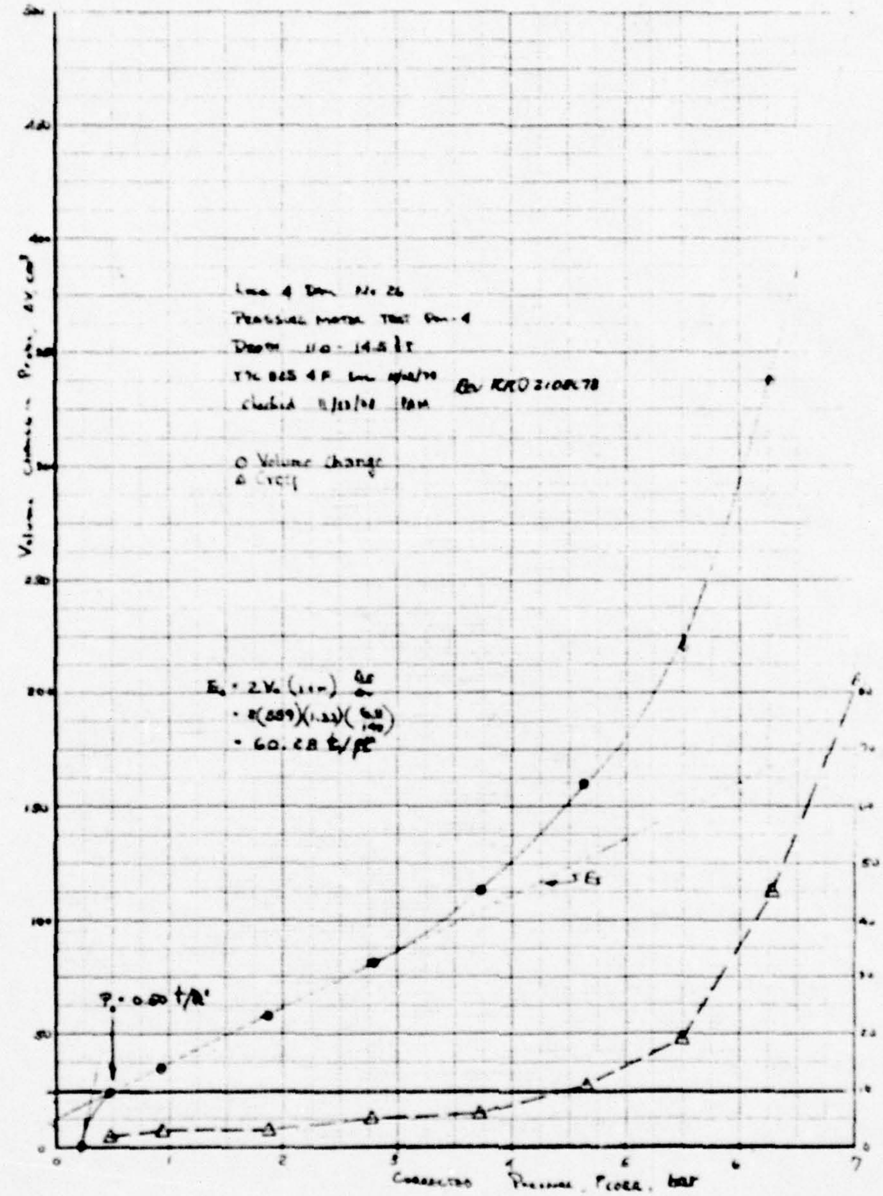
Legend

- *Probe volume change versus corrected pressure*

- *Creep versus corrected pressure*

P_o *In situ horizontal stress*

E_s *Elastic deformation modulus*



Legend

... volume change versus ...cted pressure

... versus corrected ...sure

...u horizontal stress

...c deformation ...ulus

PILE DRIVING EFFECTS TEST PROGRAM

PRESSUREMETER TEST RESULTS

BEFORE TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM

EXISTING LOCKS AND DAM No. 26

ST LOUIS DISTRICT, CORPS OF ENGINEERS

DACW43-78-C-0000

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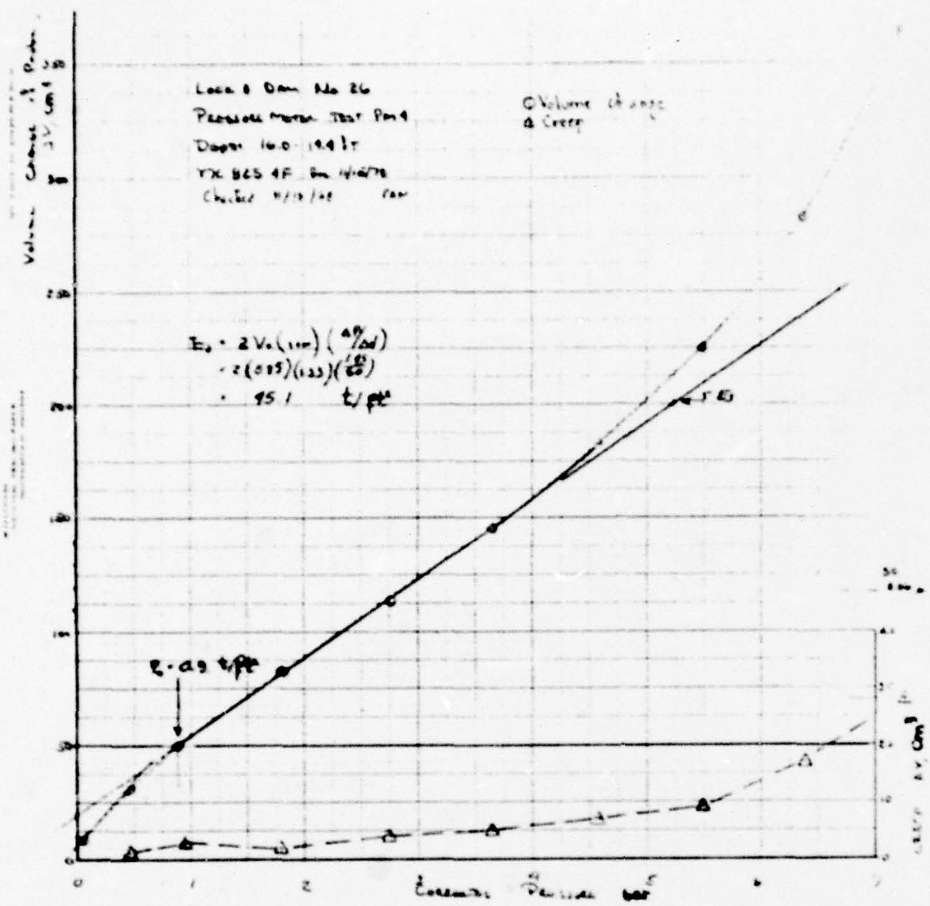
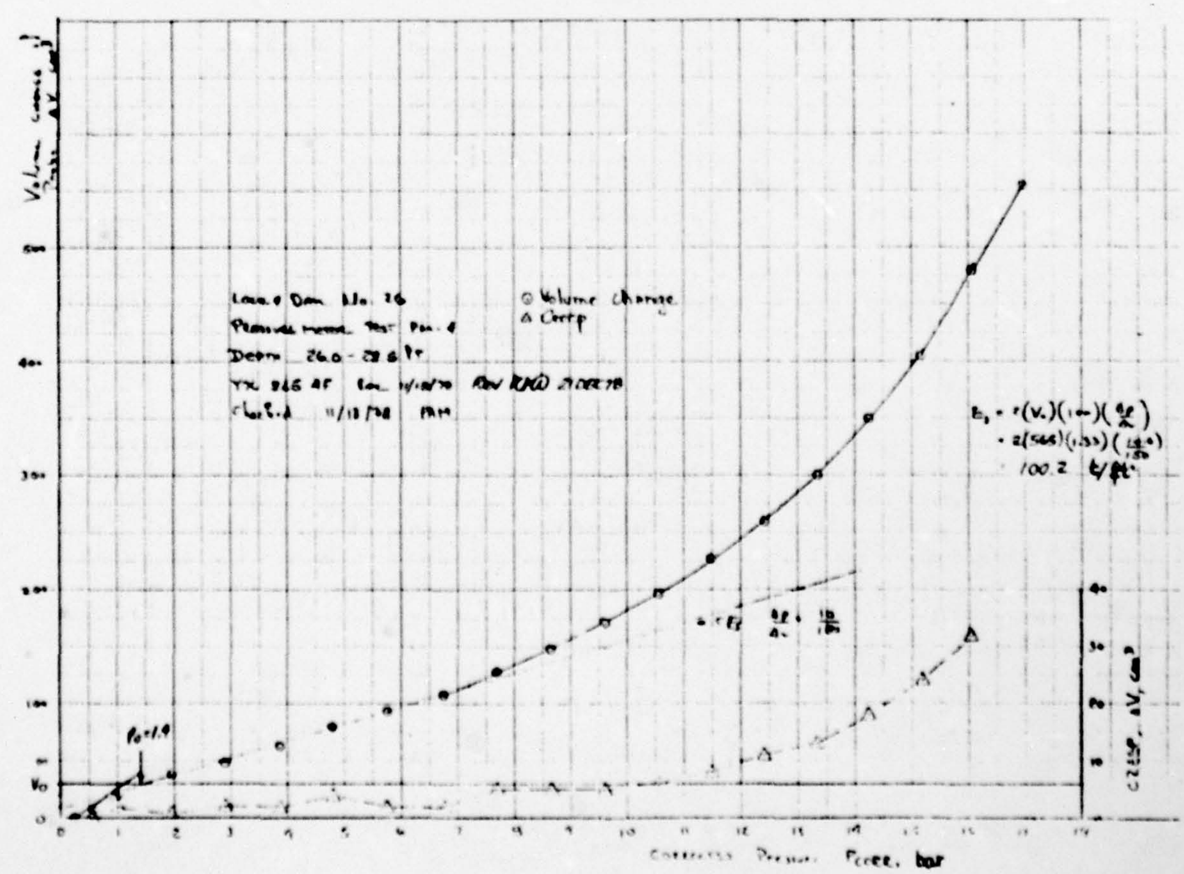
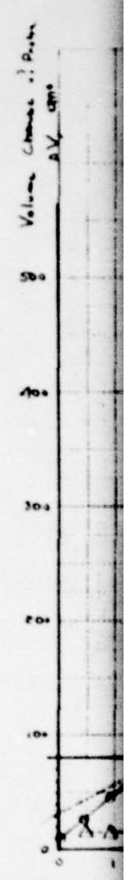
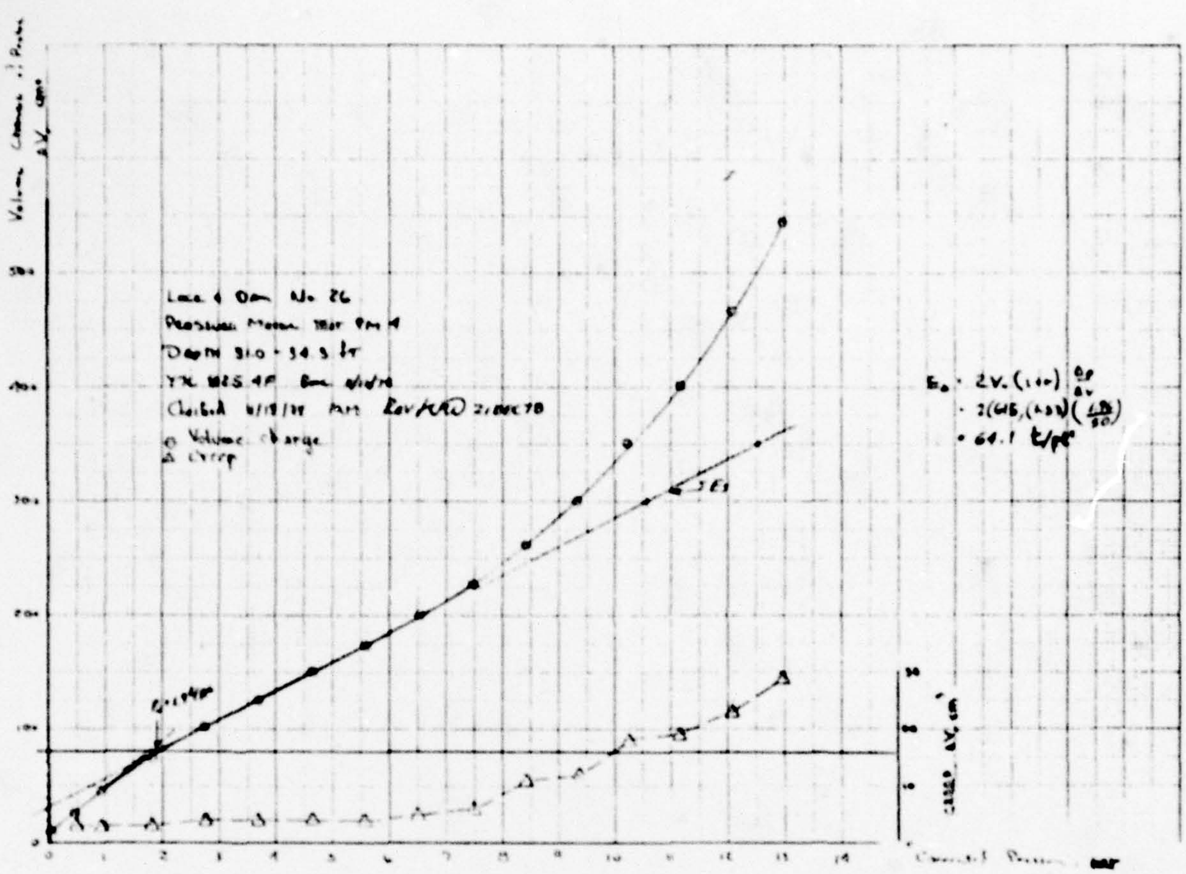
Fig. K.15

1 2


Lock & Dam No. 26
Pressure Meter Test Pm 4
O Volume change
Δ Creep
Volume Change, ΔV, cm³
Corrected Pressure, bar


Lock & Dam No. 26
Pressure meter Test Pm 4
⊙ Volume change
Δ Creep
100.2 t/ft²
Po=1.9
Vo
Volume Change, ΔV, cm³
Corrected Pressure, bar





Legend

- —⊖— *Probe volume change versus corrected pressure*
- - -△- - *Creep versus corrected pressure*
- P_o *In situ horizontal stress*
- E_s *Elastic deformation modulus*

PILE DRIVING EFFECTS TEST PROGRAM

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FOUNDATION INVESTIGATION AND TEST PROGRAM
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ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0000

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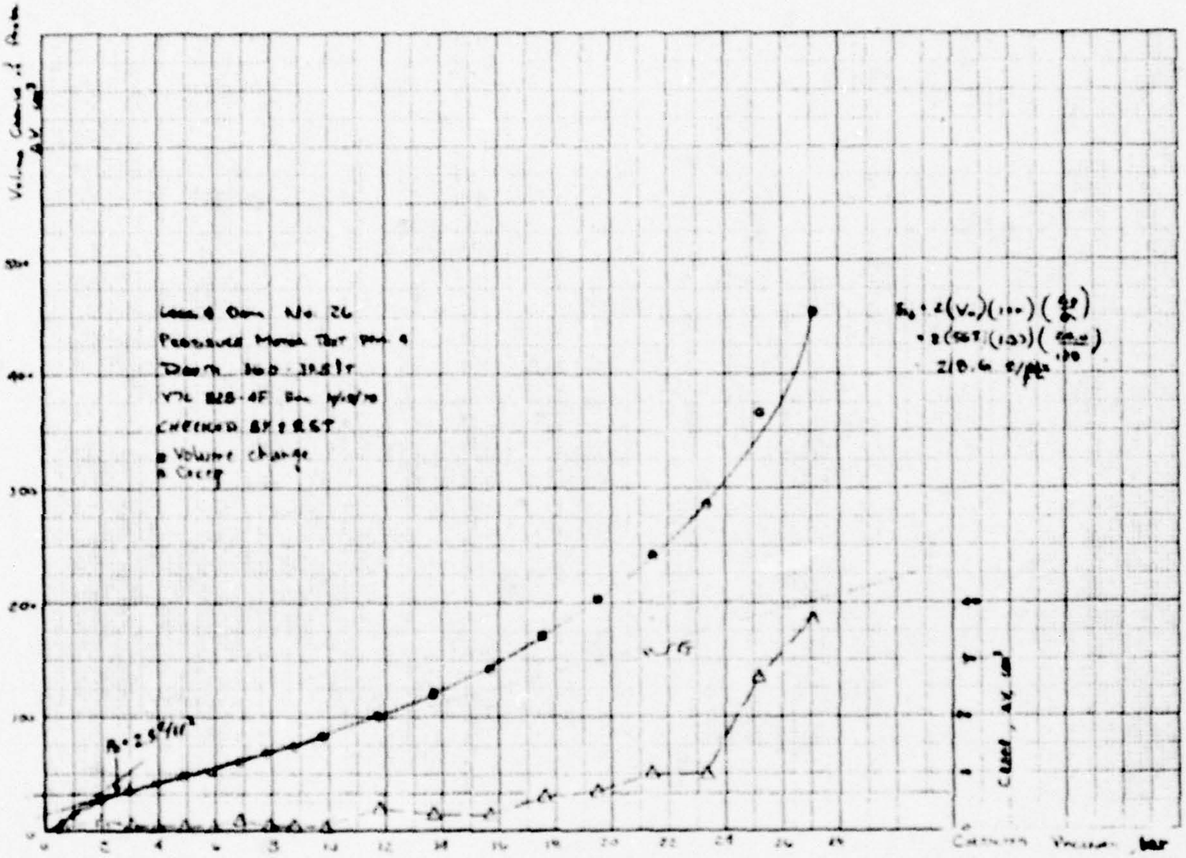
VTC025, Phase III, Vol IIIA

Fig. K.16

1 2



Legend

- —⊙— *Probe volume change versus corrected pressure*
- - -△- *Creep versus corrected pressure*
- P_o *In situ horizontal stress*
- E_s *Elastic deformation modulus*

PILE DRIVING EFFECTS TEST PROGRAM

PRESSUREMETER TEST RESULTS BEFORE TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0000

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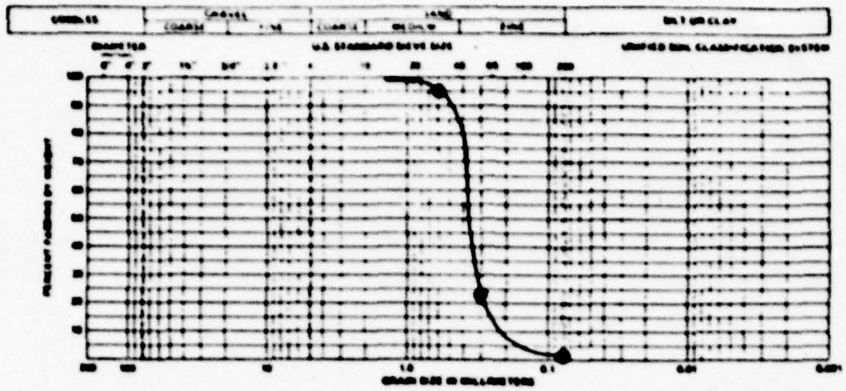
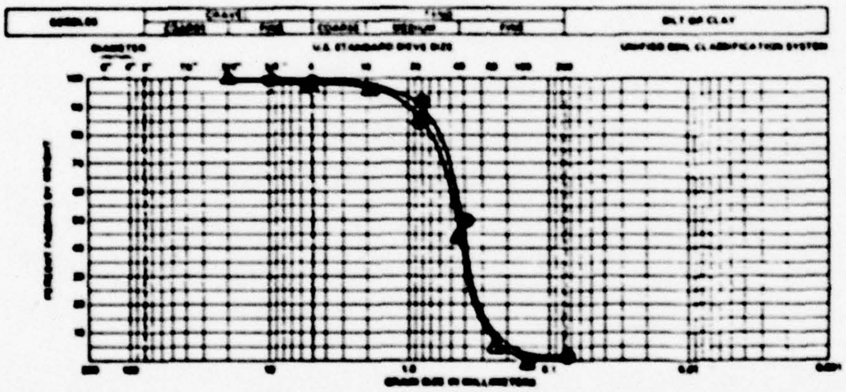
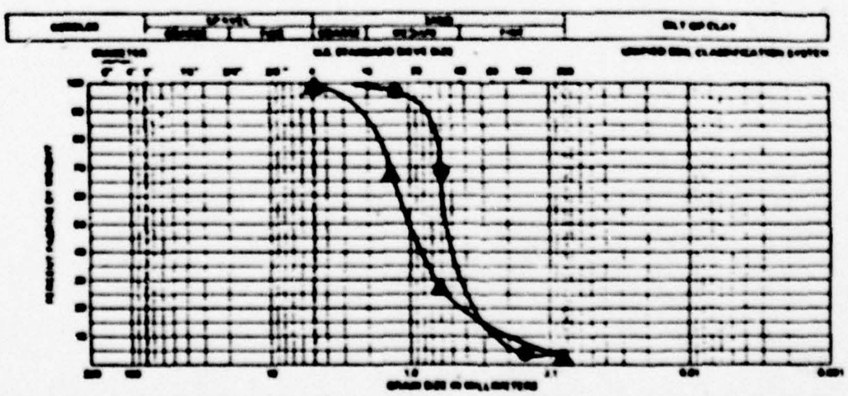
Fig. K.17



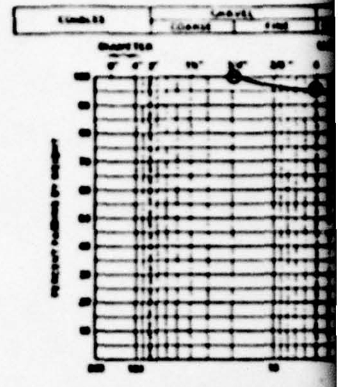
BORING	SAMPLE	DEPTH (ft)	SYMBOL	CLASSIFICATION	w (%)	w_L (%)	w_P (%)
D-1	S-5	24'	O	SP, gray f-m SAND, trace silt			



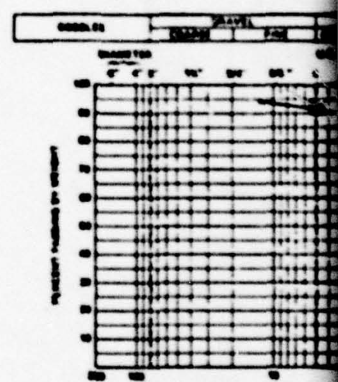
BORING	SAMPLE	DEPTH (ft)	SYMBOL	CLASSIFICATION	w (%)	w_L (%)	w_P (%)
D-1	OS-1	28.8'	O	SP, gray f-m SAND, trace silt			
D-1	OS-1	29.4'	△	SP, gray f-m SAND, trace silt			



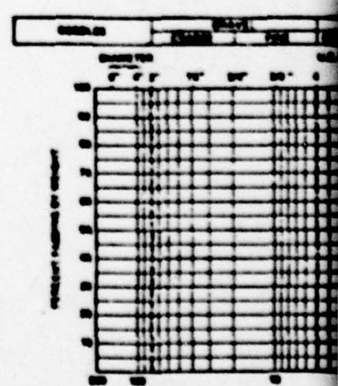
BORING	SAMPLE	DEPTH (ft)	SYMBOL	CLASSIFICATION	w (%)	w_L (%)	w_P (%)
D-1	S-6	34'	O	SP, gray m-f SAND, trace silt			
D-1	S-7	44.5'	△	SP, gray c-f SAND, trace gravel			



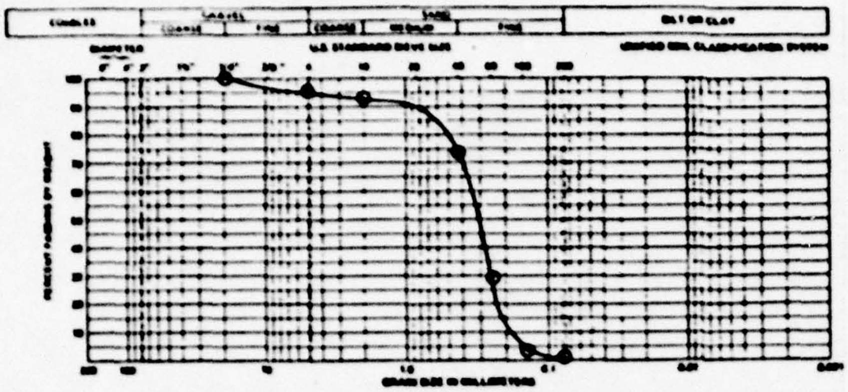
BORING	SAMPLE	DEPTH (ft)	SYMBOL	CLASSIFICATION
D-1	OS-2	40.5'	O	SP,



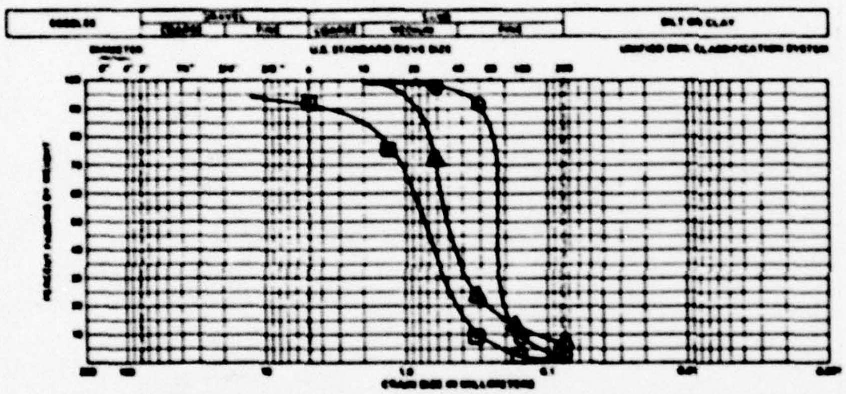
BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION
D-1	S-8	54.5'	O	SP,
D-1	S-9	64.5'	△	SP-
D-1	S-11	74.5'	□	SP,



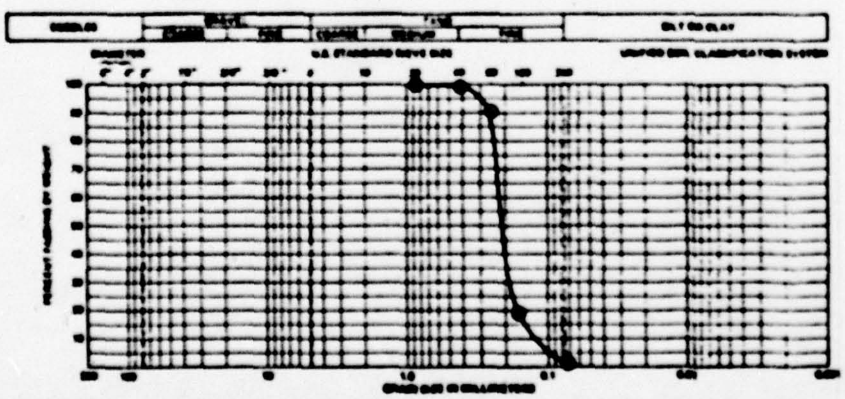
BORING	SAMPLE	DEPTH (ft)	SYMBOL	CLASSIFICATION
D-2	OS-1	29'	O	SP,



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	[illegible]	[illegible]	[illegible]
D-1	OS-2	40.5'	○	SP, gray f-c SAND, trace gravel			



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	[illegible]	[illegible]	[illegible]
D-1	S-8	54.5'	○	SP, gray f SAND, trace silt			
D-1	S-9	64.5'	△	SP-SM, gray m-f SAND, trace silt			
D-1	S-11	74.5'	□	SP, gray f-c SAND, trace gravel			



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	[illegible]	[illegible]	[illegible]
D-2	OS-1	29'	○	SP, gray f SAND, trace silt			

PILE DRIVING EFFECTS TEST PROGRAM

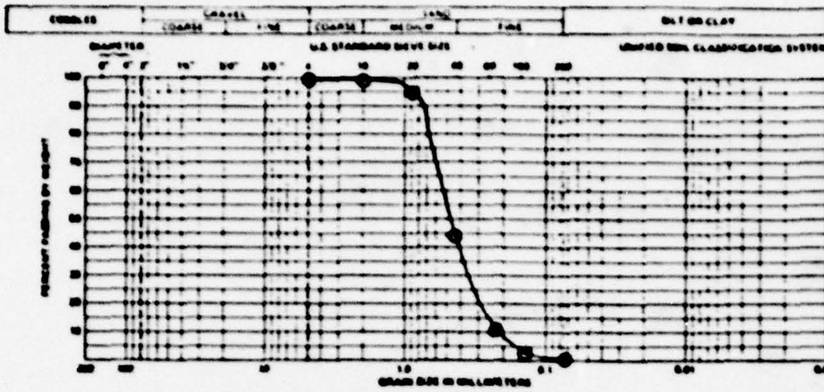
GRAIN-SIZE DISTRIBUTION OF SERIES D BORINGS

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

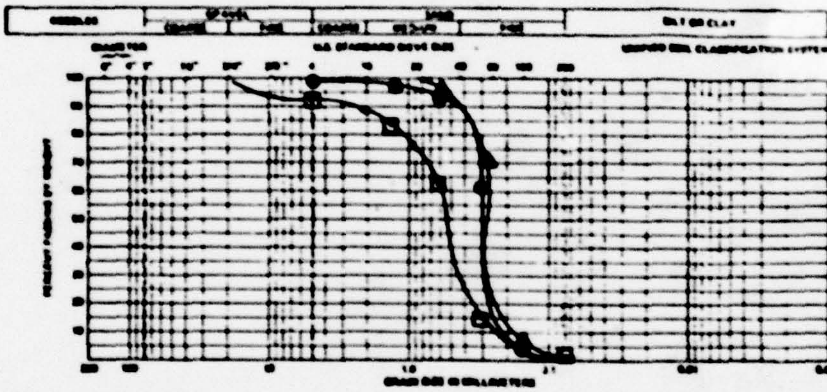
Woodward-Clyde Consultants
77C029, Phase III, Vol IIIA

Fig. K.18

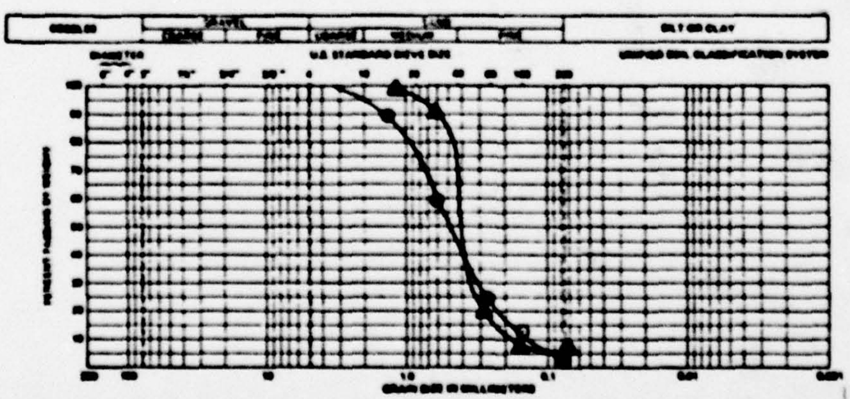
1 2



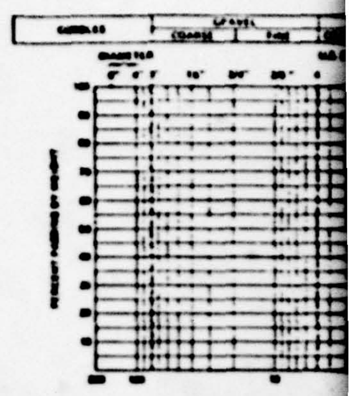
BORING	SAMPLE	DEPTH (FT)	SYMBOL	CLASSIFICATION	w (%)	w_L (%)	w_P (%)
D-2	OS-2	35.4'	⊙	SP, gray m-f SAND, trace silt			



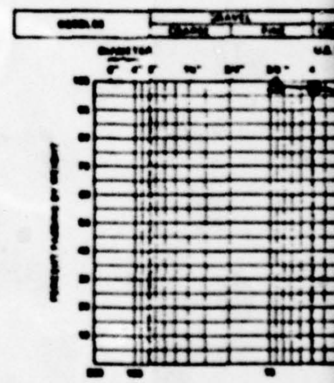
BORING	SAMPLE	DEPTH (FT)	SYMBOL	CLASSIFICATION	w (%)	w_L (%)	w_P (%)
D-2	S-4	19'	⊙	SP, light brown f SAND, trace silt			
D-2	S-6	39.5'	▲	SP, gray f SAND, trace silt			
D-2	S-7	49'	⊡	SP, gray m-f SAND, trace gravel			



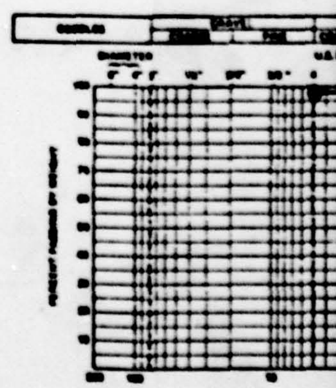
BORING	SAMPLE	DEPTH (FT)	SYMBOL	CLASSIFICATION	w (%)	w_L (%)	w_P (%)
D-2	S-8	55'	⊙	SP, gray m-f SAND, trace gravel			
D-2	S-9	65'	▲	SP-SM, gray m-f SAND, trace silt			



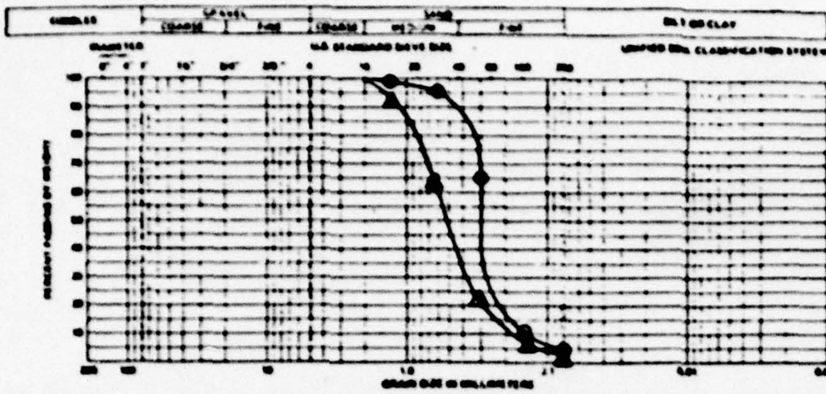
BORING	SAMPLE	DEPTH (FT)	SYMBOL	CLASSIFICATION
D-5	S-6	29'	⊙	SP,
D-5	OS-1	34'	△	SP,



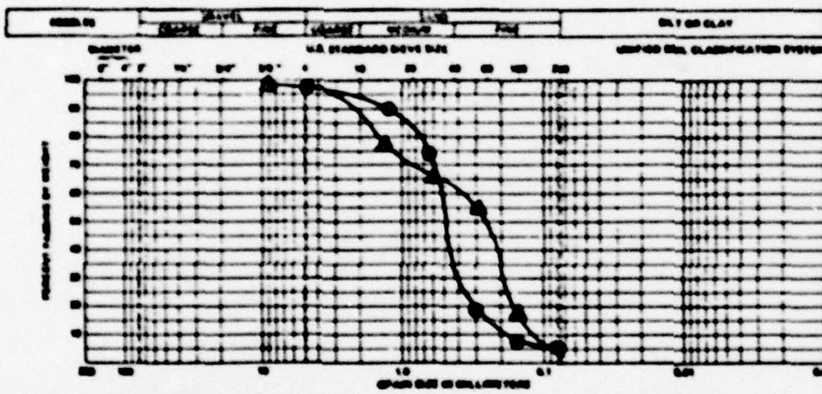
BORING	SAMPLE	DEPTH (FT)	SYMBOL	CLASSIFICATION
D-5	S-8	49'	⊙	SP-
D-5	OS-3	54'	△	SP,



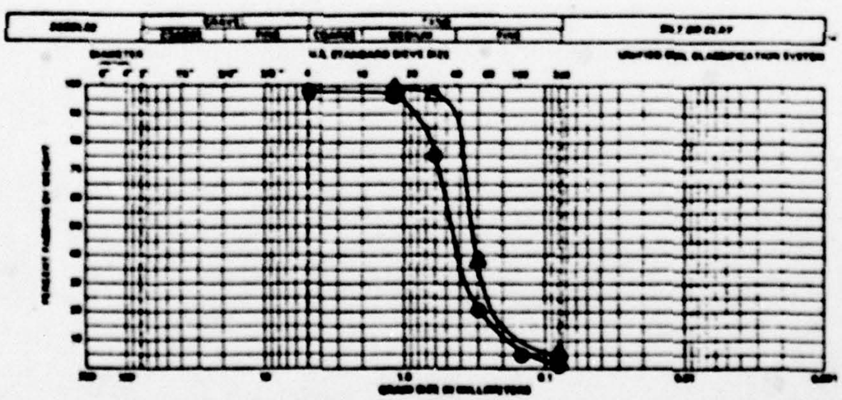
BORING	SAMPLE	DEPTH (FT)	SYMBOL	CLASSIFICATION
D-6	S-6	29.5'	⊙	SP,
D-6	S-11	54.5'	▲	SP-S



D-5	S-6	29'	○	SP, light gray f SAND, trace silt			
D-5	OS-1	34'	△	SP, light gray f-m SAND, trace silt			



D-5	S-8	49'	○	SP-SM, light gray m-f SAND, trace silt			
D-5	OS-1	54'	△	SP, light gray m-f SAND, trace gravel			



D-6	S-6	29.5'	○	SP, light gray m-f SAND			
D-6	S-11	54.5'	△	SP-SM, light gray f SAND, trace silt			

PILE DRIVING EFFECTS TEST PROGRAM

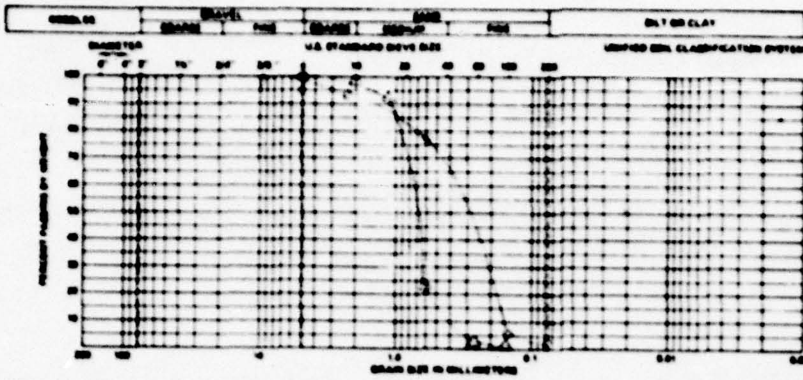
GRAIN-SIZE DISTRIBUTION OF SERIES D BORINGS

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0008

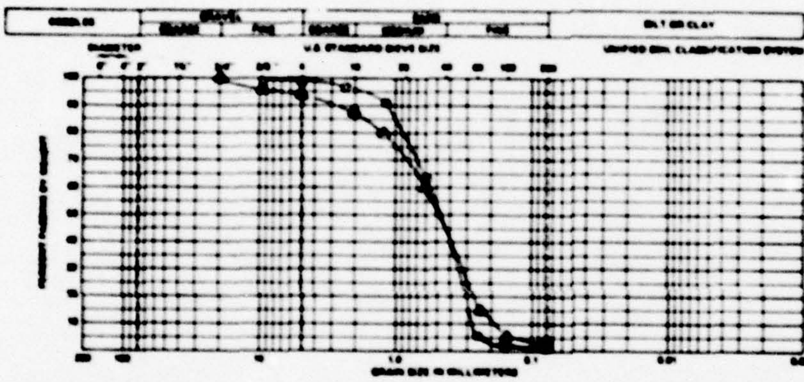
Woodward-Clyde Consultants
77C029, Phase II, Vol IIIA

Fig. K.19

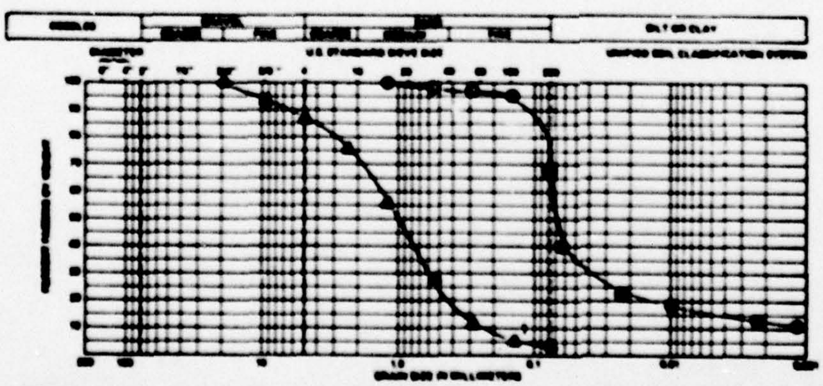
1 2



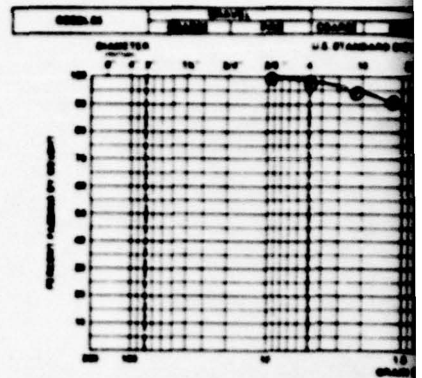
[illegible]	[illegible]	[illegible]	[illegible]	CLASSIFICATION	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	o	SP, Gray fine to coarse SAND,			
				trace fine gravel (B)			
[illegible]		15	▲	SP, Gray medium SAND [illegible]			



[illegible]	[illegible]	[illegible]	[illegible]	CLASSIFICATION	[illegible]	[illegible]	[illegible]
PD2-SP1		15	o	SP, Gray-brown fine to medium			
				SAND, trace silt (C)			
PD2-SP1		18	▲	SP, Gray fine to coarse SAND,			
				trace silt, trace fine gravel (D)			

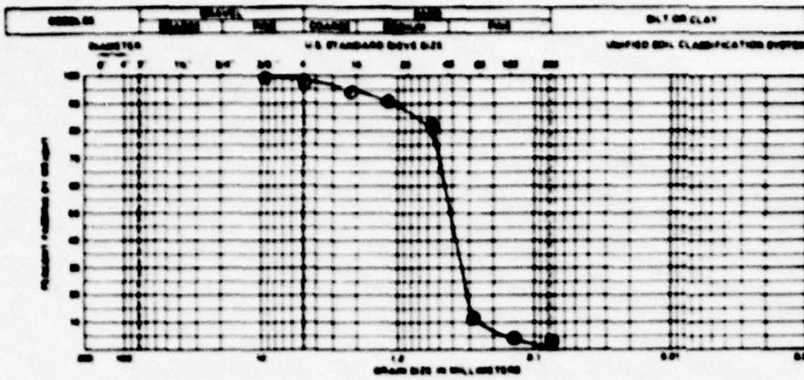


[illegible]	[illegible]	[illegible]	[illegible]	CLASSIFICATION	[illegible]	[illegible]	[illegible]
PD2-SP1		84	o	ML, gray fine sandy SILT, trace			
				clay (E)			
PD2-SP1		28.5	▲	SP, gray fine to coarse SAND,			
				some fine gravel (G)			



[illegible]	[illegible]	[illegible]	[illegible]	
PD2-SP1		37	o	SP, gray fi[illegible]
				trace si[illegible]
				gravel

1



Boring	Sample	Depth (ft)	Symbol	Classification	[illegible]	[illegible]	[illegible]
[illegible]		37	O	SP, gray fine to coarse SAND, trace silt, trace fine gravel (J1)			

PILE DRIVING EFFECTS TEST PROGRAM

GRAIN-SIZE DISTRIBUTION OF SERIES PD-2 BORINGS

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0083

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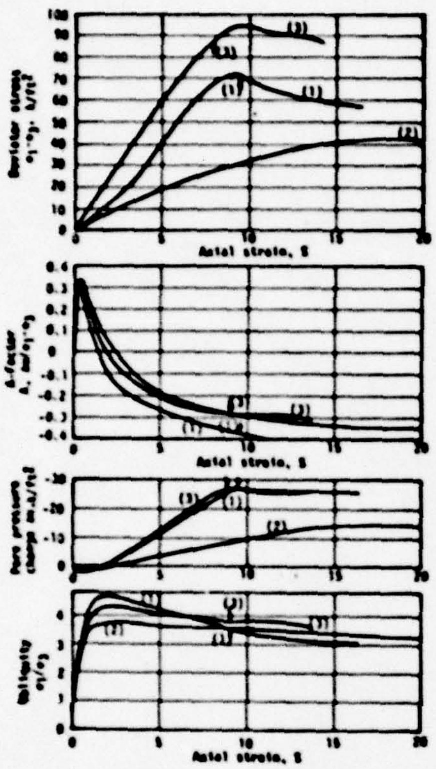
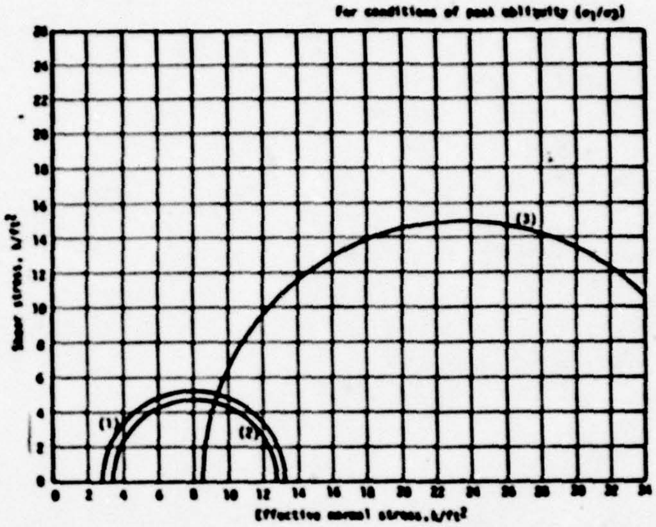
Fig. K.20

1 2





Notes:

1. σ_{3c} = 1.70k/ft^2, boring B-1 @ 20.4 ft
   D_r = 68% after consolidation
2. σ_{3c} = 3.40k/ft^2, boring B-1 @ 20.8 ft
   D_r = 51% after consolidation
3. σ_{3c} = 6.80k/ft^2, boring B-1 @ 40.5 ft
   D_r = 72% after consolidation
4. Tests performed on SP sand
5. Specimens: 2.8-in.-dia. by 6-in. height
6. Strain rate about 3%/hr

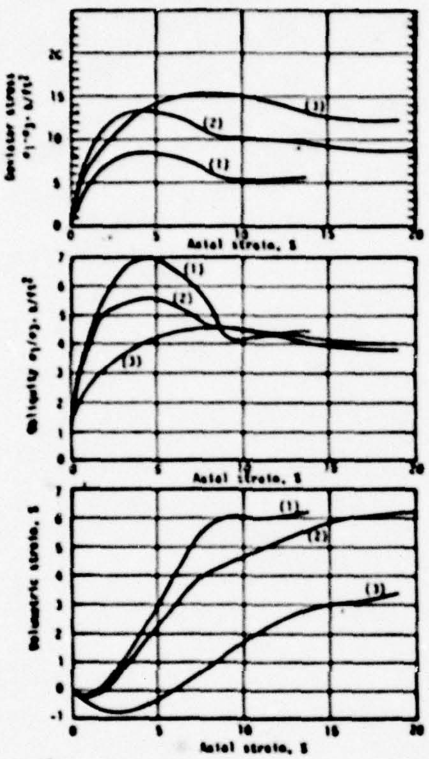
PILE DRIVING EFFECTS TEST PROGRAM

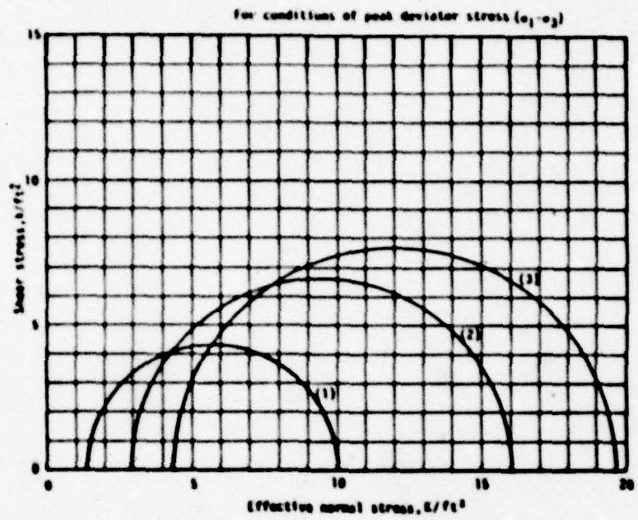
RESULTS OF $\overline{\text{CID}}$ TRIAXIAL COMPRESSION TESTS UNDISTURBED SAMPLES

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0093

Woodward-Clyde Consultants
77C029, Phase III; Vol IIIA

Fig. K.21





Notes:

1. σ_c = 1.63k/ft^2, boring D-2 @ 29.7 ft
   D_r = 79% after consolidation
2. σ_c = 2.08k/ft^2, boring D-2 @ 29 ft
   D_r = 77% after consolidation
3. σ_c = 4.33k/ft^2, boring D-2 @ 35.4 ft
   D_r = 90% after consolidation
4. Tests performed on SP sand
5. Specimens 2.9-in.-dia. by 6-in. height
6. Strain rate about 3%/hr

PILE DRIVING EFFECTS TEST PROGRAM

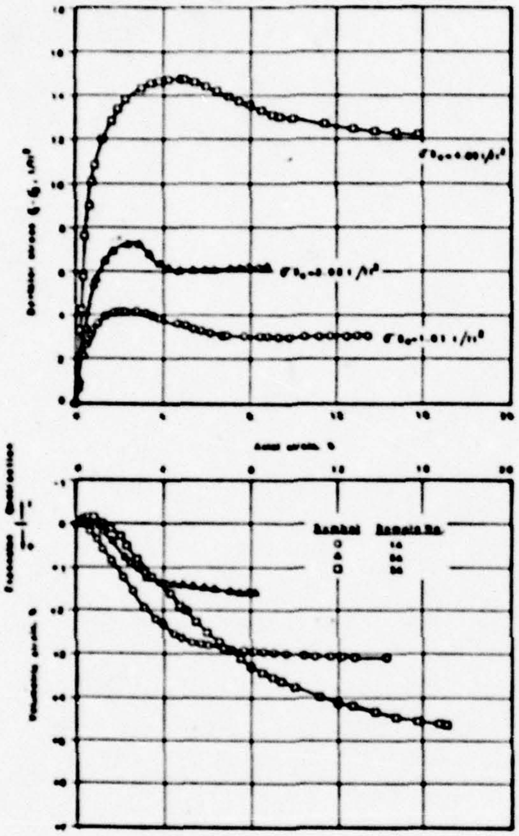
RESULTS OF $\overline{\text{CID}}$ TRIAXIAL COMPRESSION TESTS UNDISTURBED SAMPLES

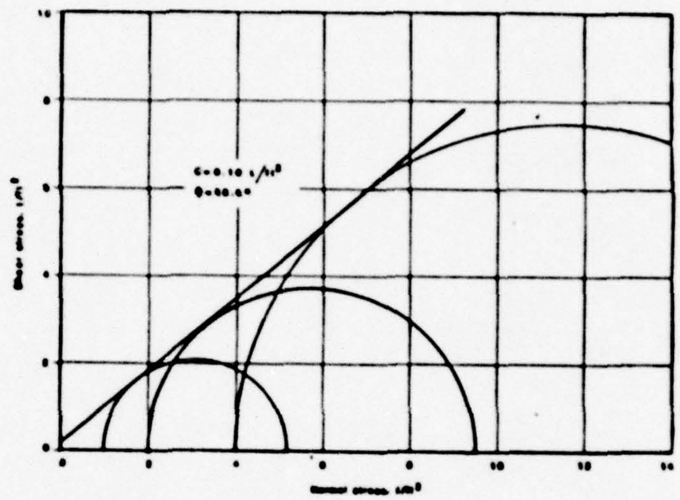
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0066

Woodward-Clyde Consultants

77C026, Phase III, Vol IIIA

Fig. K.22





Notes

1. Axial strain rate = 0.3 %/min
2. Sand samples were reconstituted at D_r=70% (γ_d 100 lb/ft³)
3. Sand samples were 2.8-in.-dia. and 6.0-in.-high

PILE DRIVING EFFECTS TEST PROGRAM

RESULTS OF $\overline{CID}$ TRIAXIAL COMPRESSION TESTS RECONSTITUTED SAMPLES

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-[illegible]

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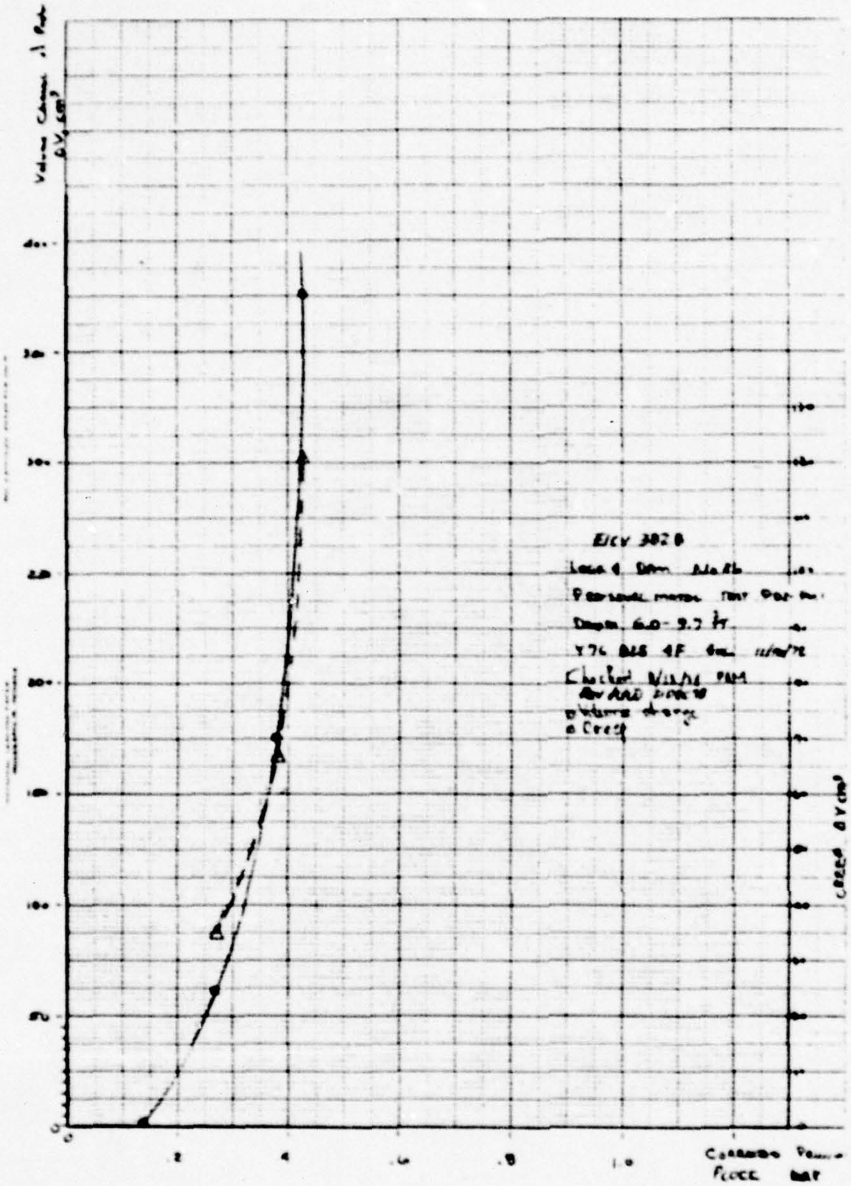
77C829, Phase III; Vol III A

Fig. K.23



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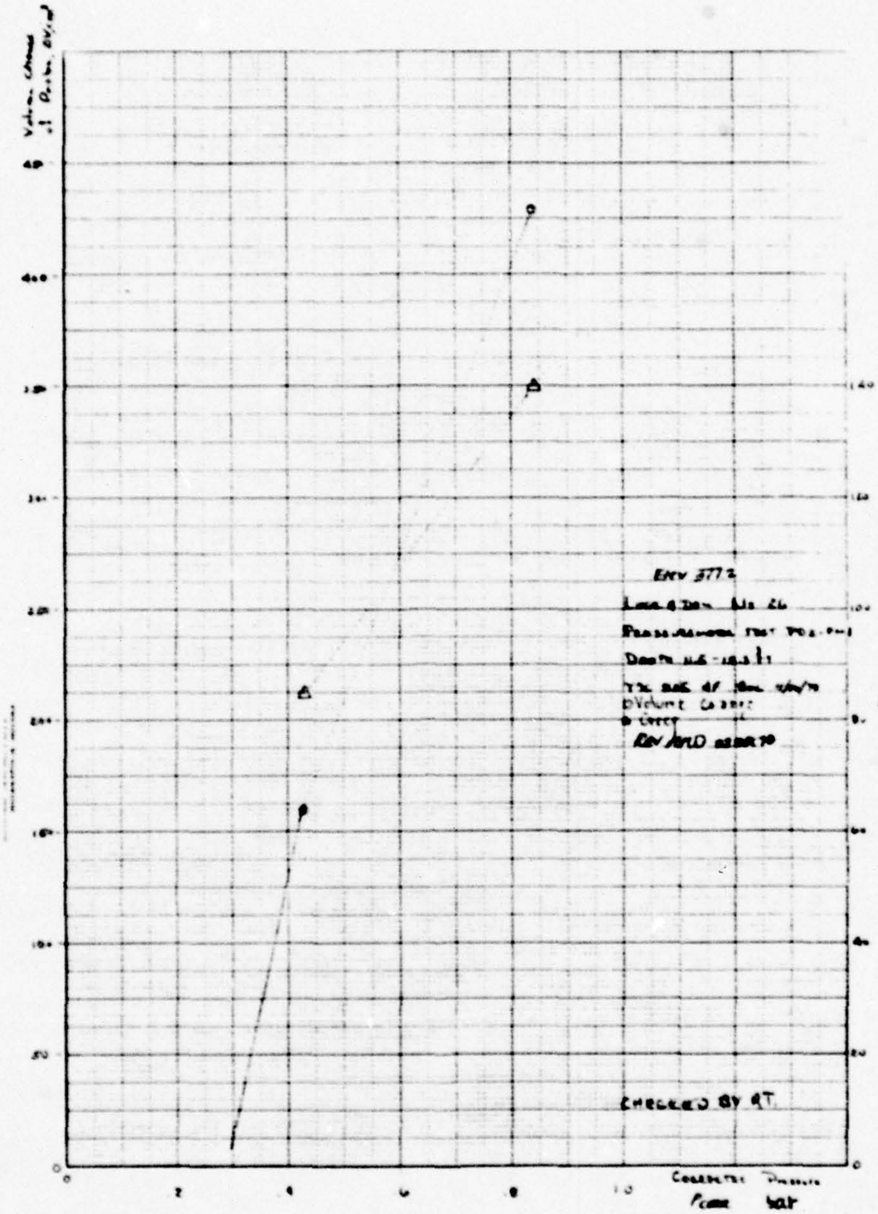


Legend

-o- Probe volume change versus corrected pressure

-Δ- Creep versus corrected pressure

PILE DRIVING EFFECTS TEST PROGRAM

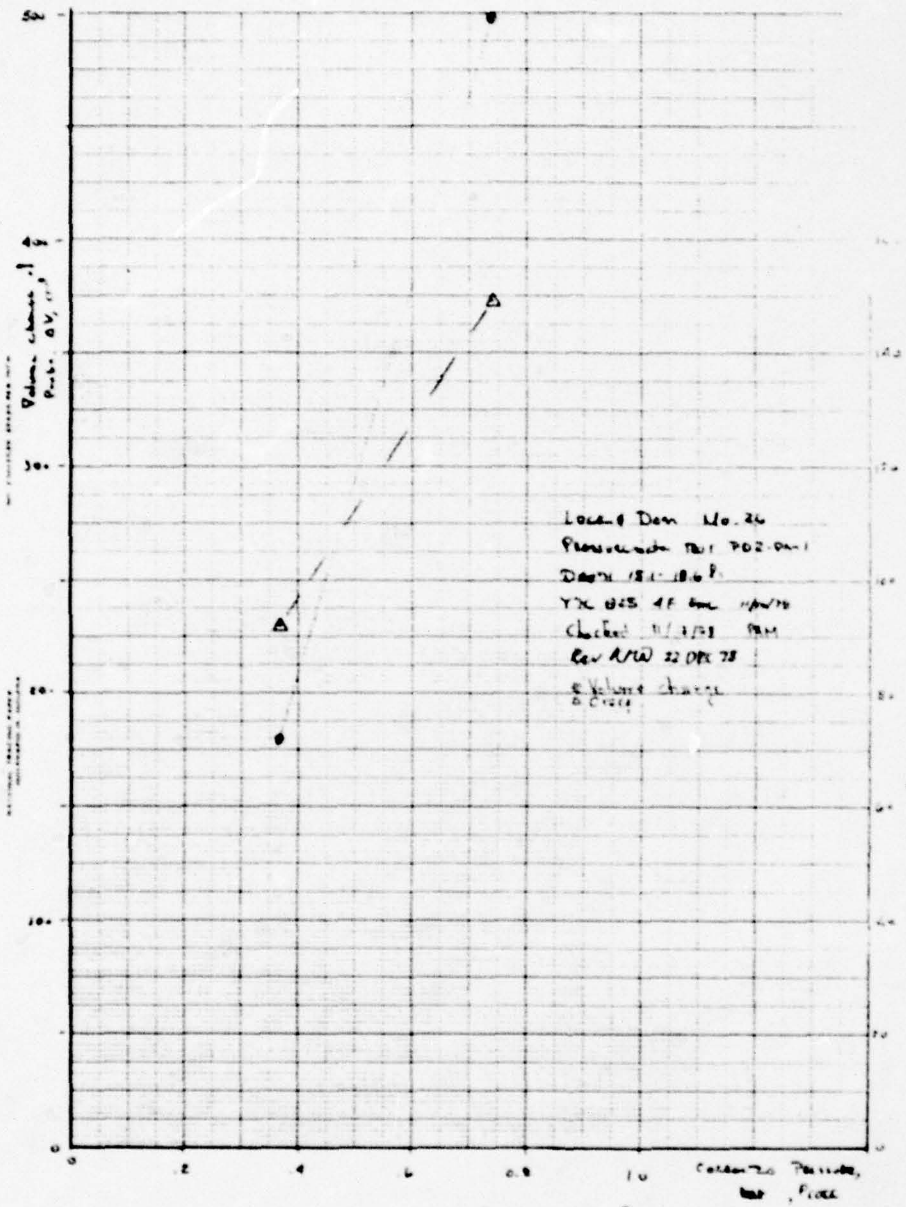
PRESSUREMETER TEST RESULTS AFTER TIMBER PILE INSTALLATION

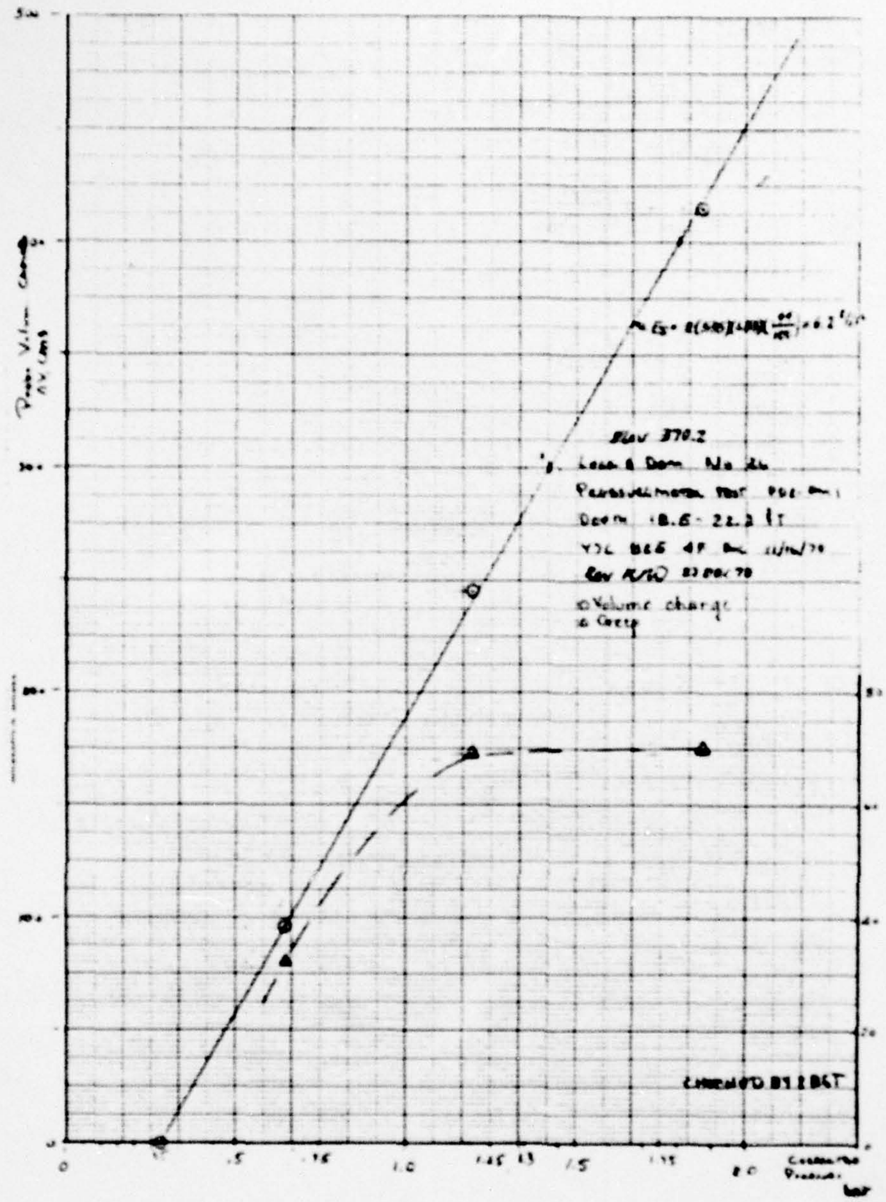
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants
77C025, Phase III; Vol III A

FIG. K.24

1 2


Lock & Dam No. 26
Rev R/W 22 DEC 78
Volume change



Legend

-⊙- *Probe volume change versus corrected pressure*

-▲- *Creep versus corrected pressure*

P_o *In situ horizontal stress*

E_s *Elastic deformation modulus*

PILE DRIVING EFFECTS TEST PROGRAM

PRESSUREMETER TEST RESULTS AFTER TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

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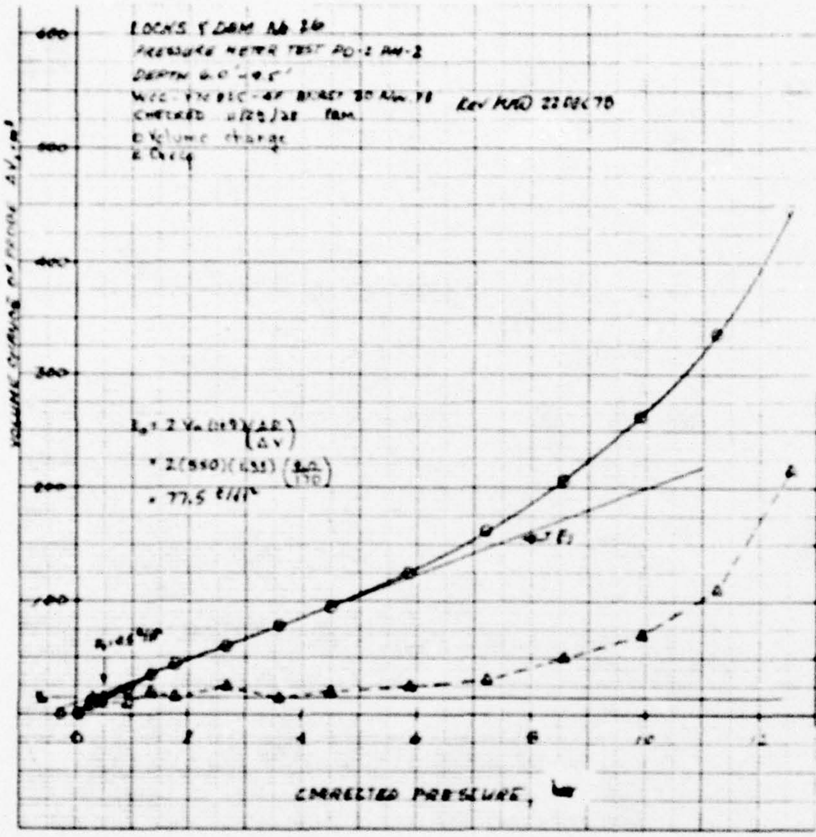
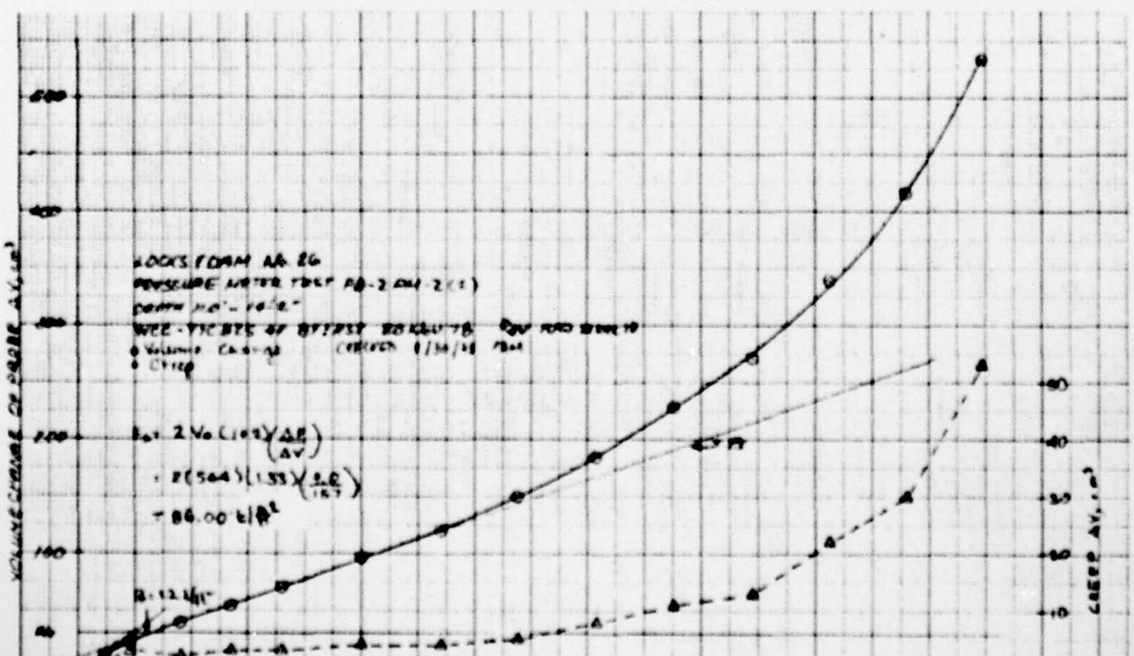
77C026, Phase III; Vol IIIA

Fig. K.25

1 2





—●— Pr
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P_o In
E_g Ele
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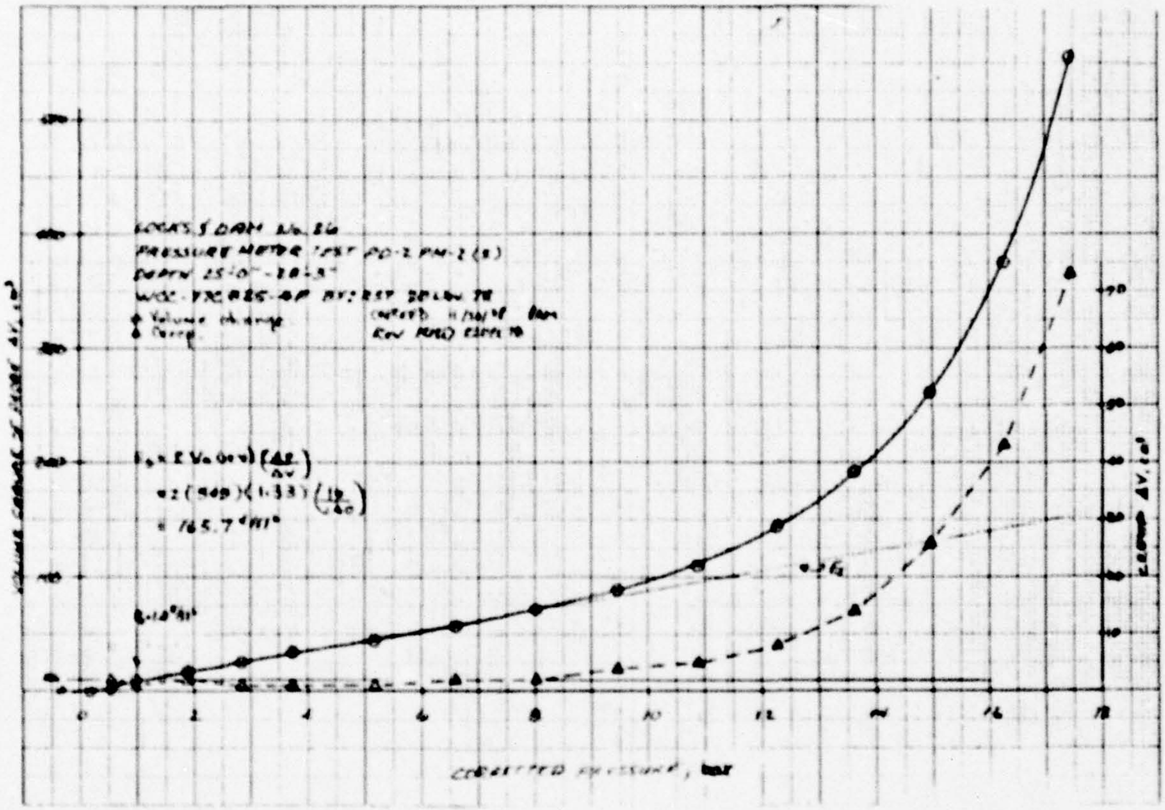
1



Legend

—●— *Probe volume change versus corrected pressure*

-△- *Creep versus corrected pressure*

P_o *In situ horizontal stress*

E_s *Elastic deformation modulus*

PILE DRIVING EFFECTS TEST PROGRAM

PRESSUREMETER TEST RESULTS AFTER TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

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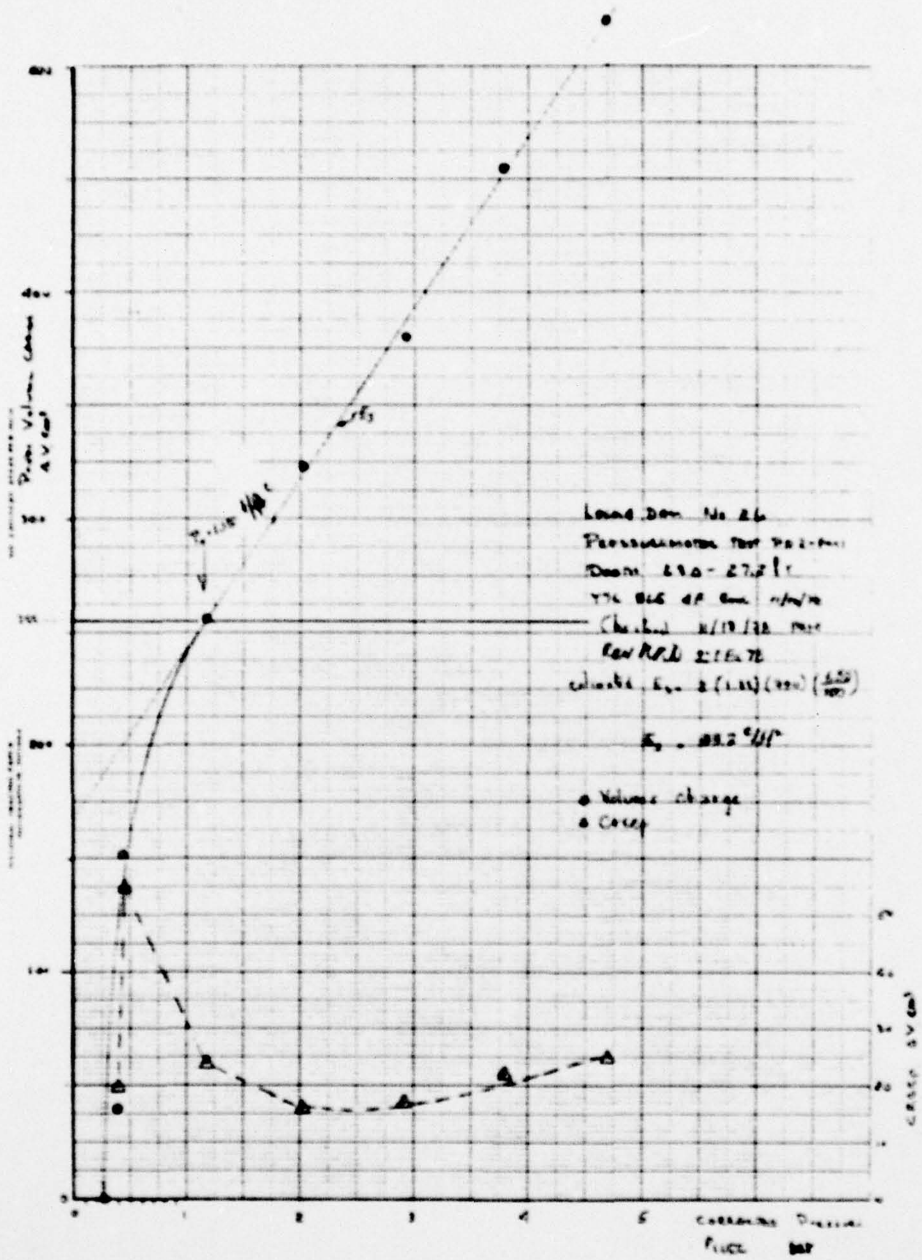
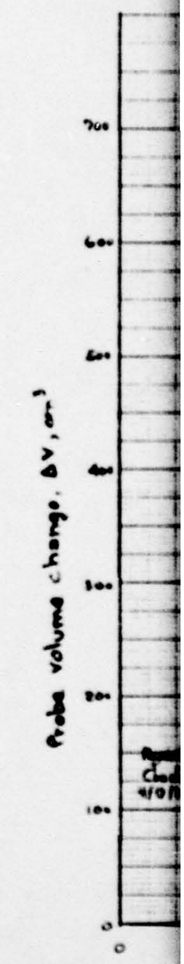
Fig K.26

77C020, Phase III, Vol III A

2

1.





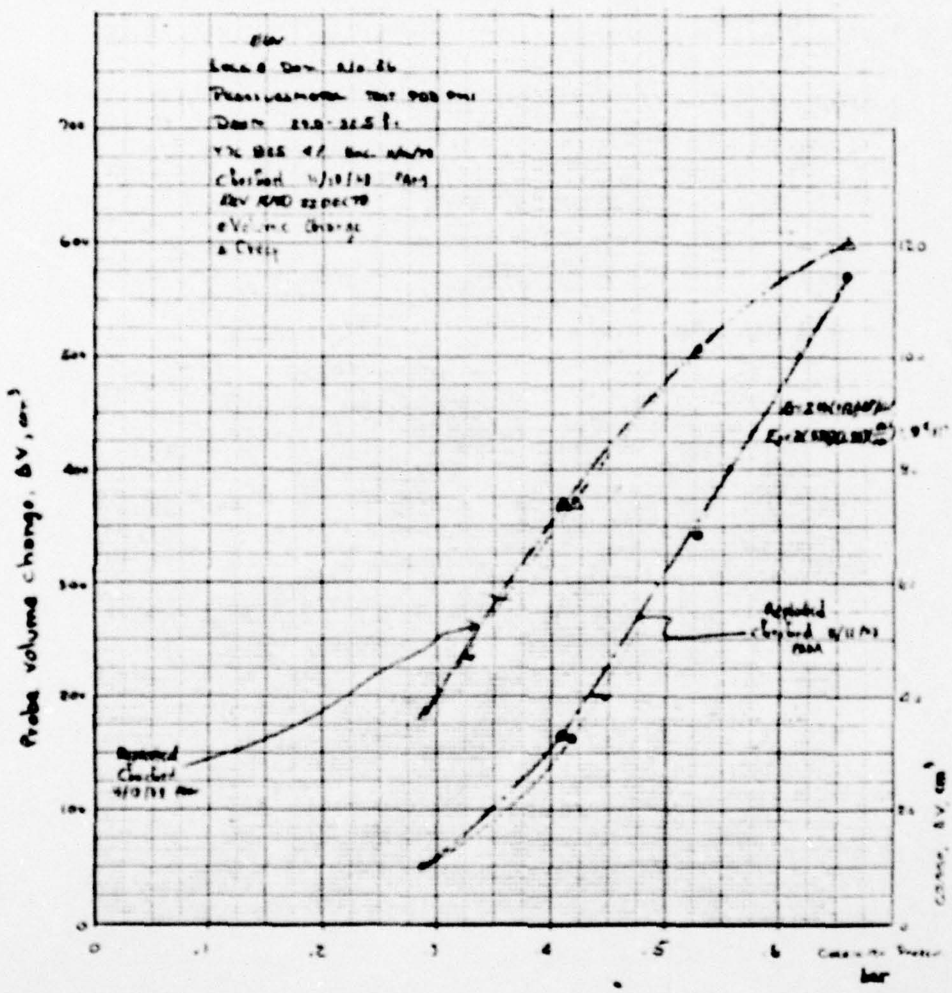
-●- Probe
corre

-▲- Creep
press

P_o In sit

E_s Elasti
mode

1

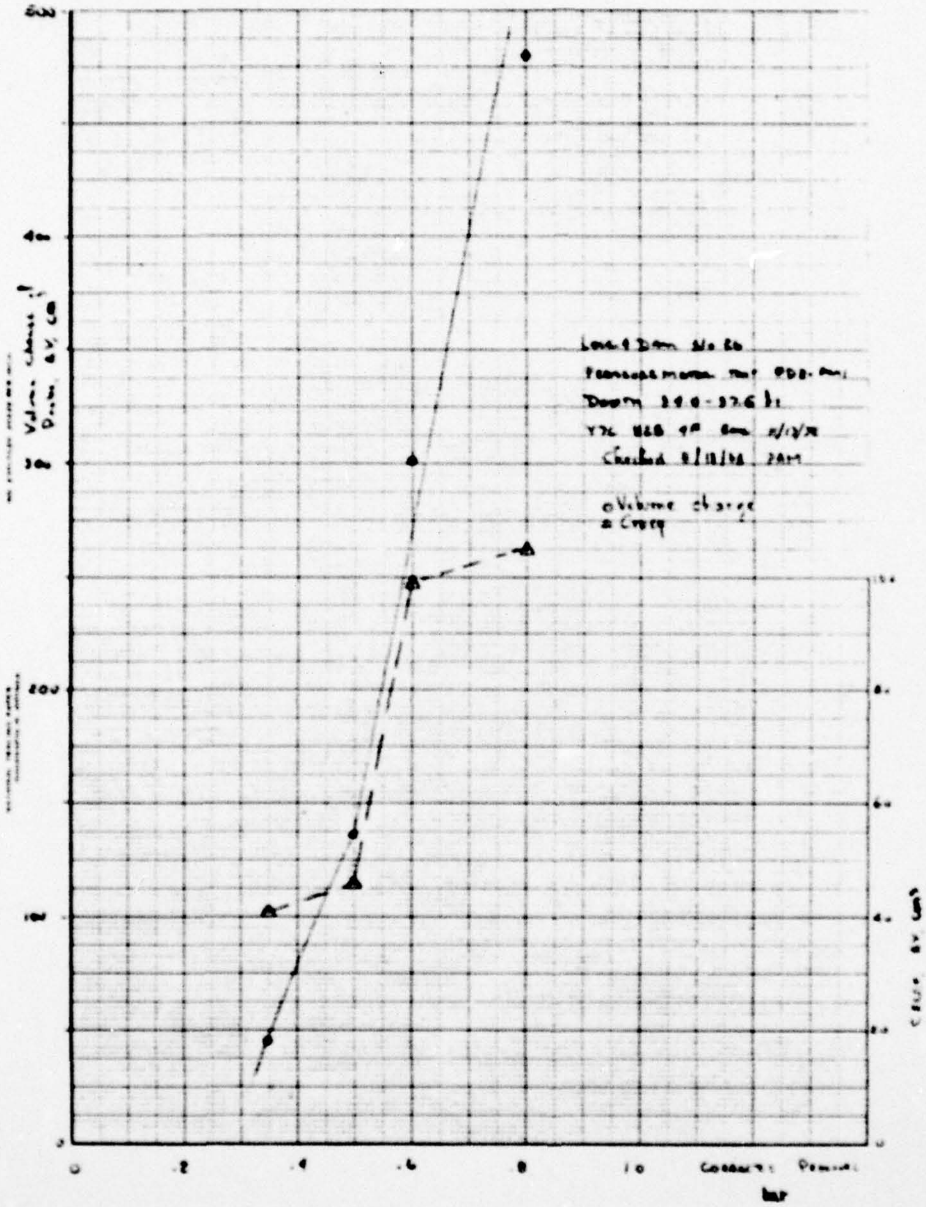


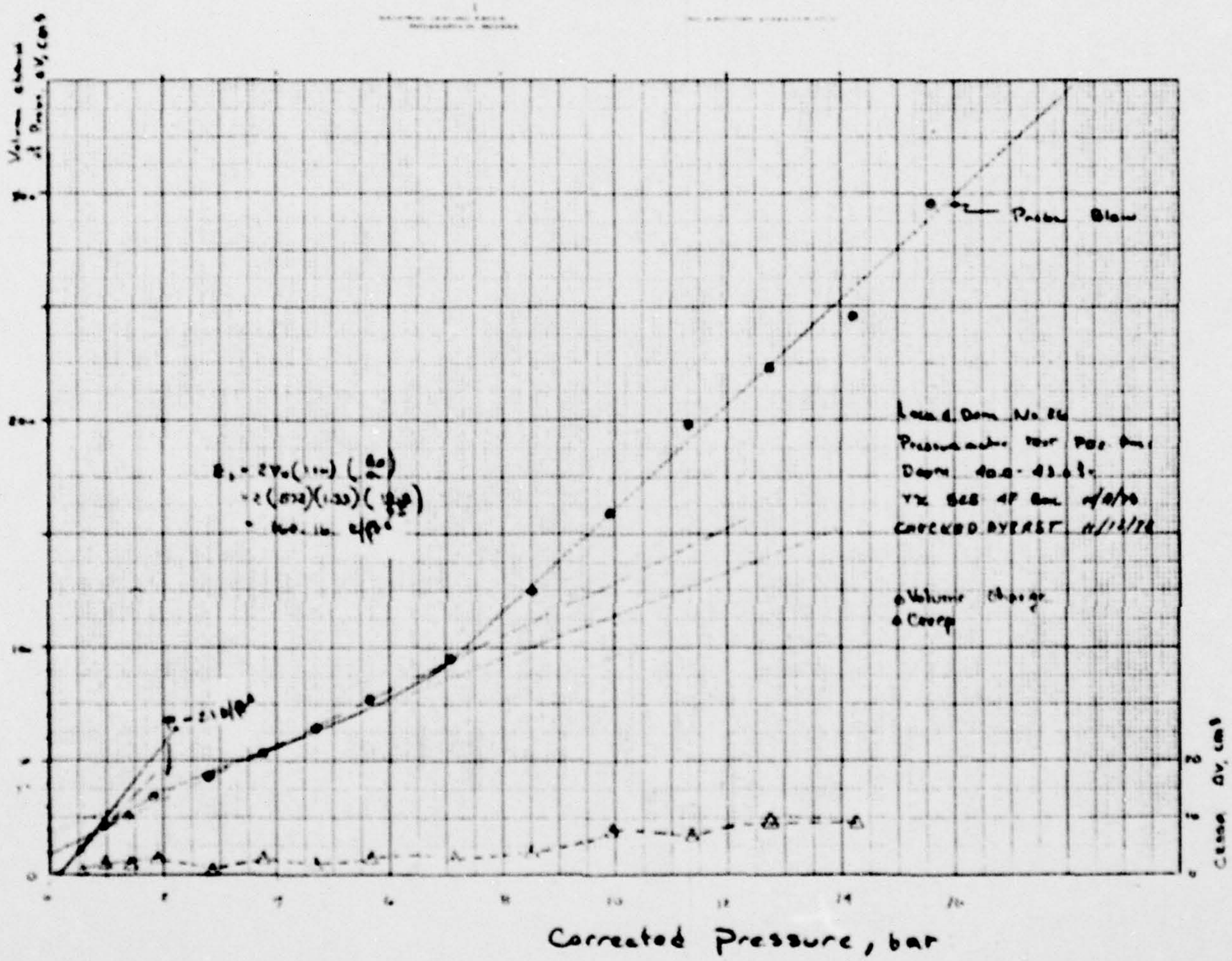
Legend

- —●— Probe volume change versus corrected pressure
- -▲ Creep versus corrected pressure
- P_o In situ horizontal stress
- E_s Elastic deformation modulus

PILE DRIVING EFFECTS TEST PROGRAM
PRESSUREMETER TEST RESULTS AFTER TIMBER PILE INSTALLATION
FOUNDATION INVESTIGATION AND TEST PROGRAM EXISTING LOCKS AND DAM No. 26 ST LOUIS DISTRICT, CORPS OF ENGINEERS. DACW43-78-C-0005
Woodward-Clyde Consultants — Fig. K.27
77C029, Phase II, Vol IIIA

1 2


Volume change
Creep
0
.2
.4
.6
.8
1.0
bar



Legend

- Probe volume change versus corrected pressure
- Creep versus corrected pressure

P_o In situ horizontal stress

E_s Elastic deformation modulus

PILE DRIVING EFFECTS TEST PROGRAM

PRESSUREMETER TEST RESULTS

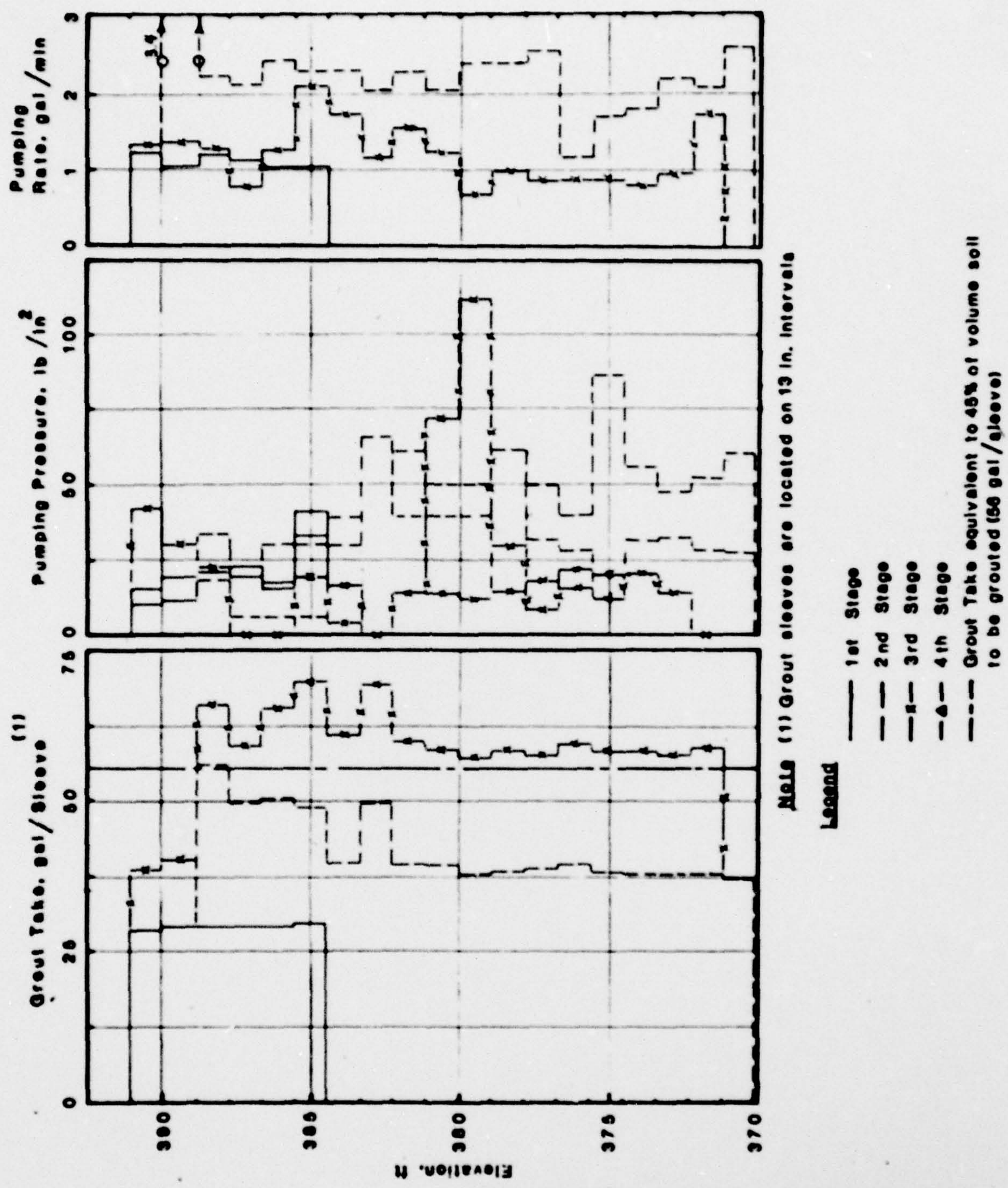
AFTER TIMBER PILE INSTALLATION

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.28

1 2



PILE DRIVING EFFECTS TEST PROGRAM

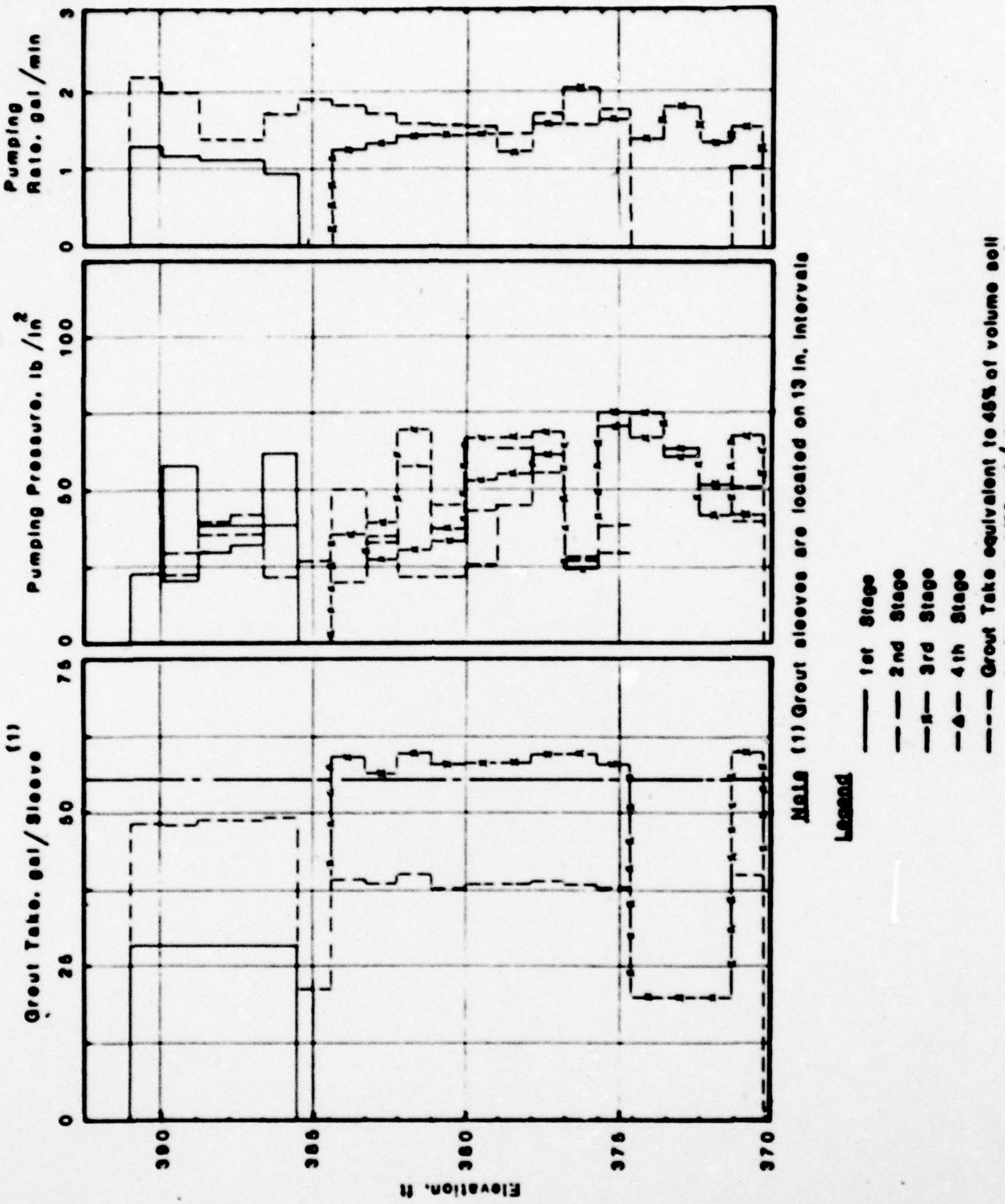
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. A-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-76-C-0066

Woodward-Clyde Consultants

77C825, Phase II; Vol III A

Fig. K.29



PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. A-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

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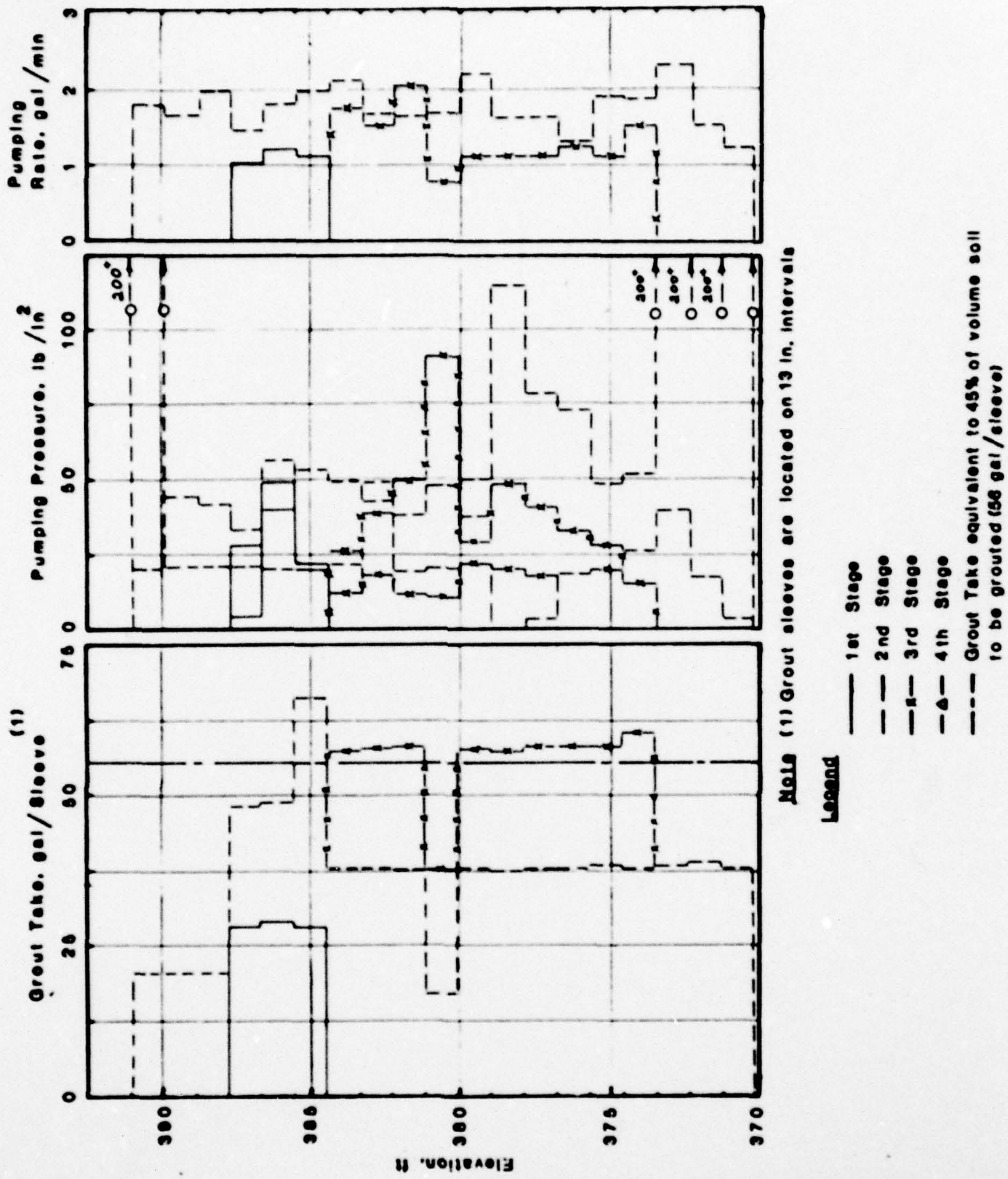
YYC025, Phase II; Vol III A

Fig. K.30



PILE DRIVING EFFECTS TEST PROGRAM

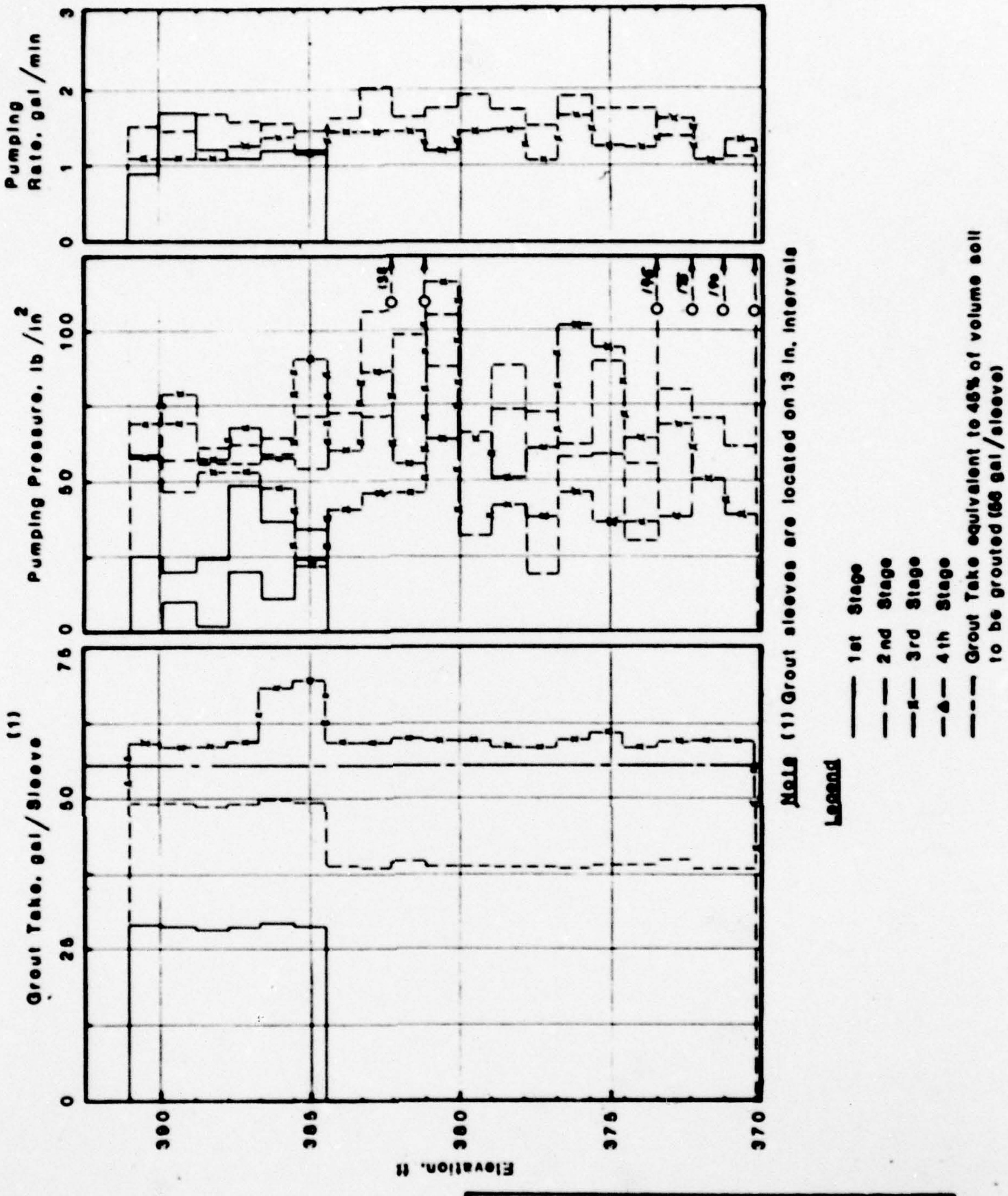
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. A-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

77C925 Phase II ; Vol III A

Fig. K.31



PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. A-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

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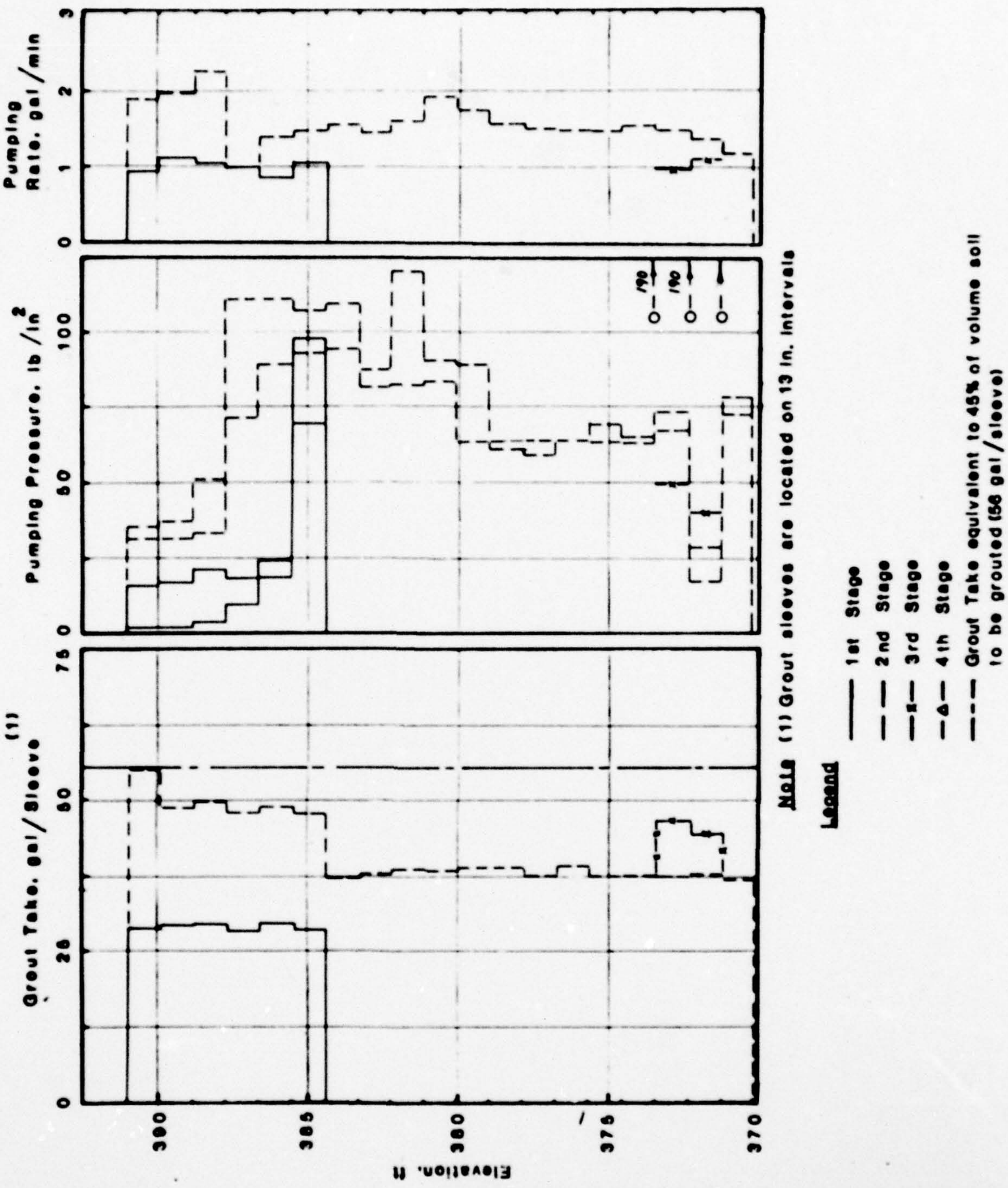
Fig. K.82

ST C825, Phase II; Vol III A



PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. A-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

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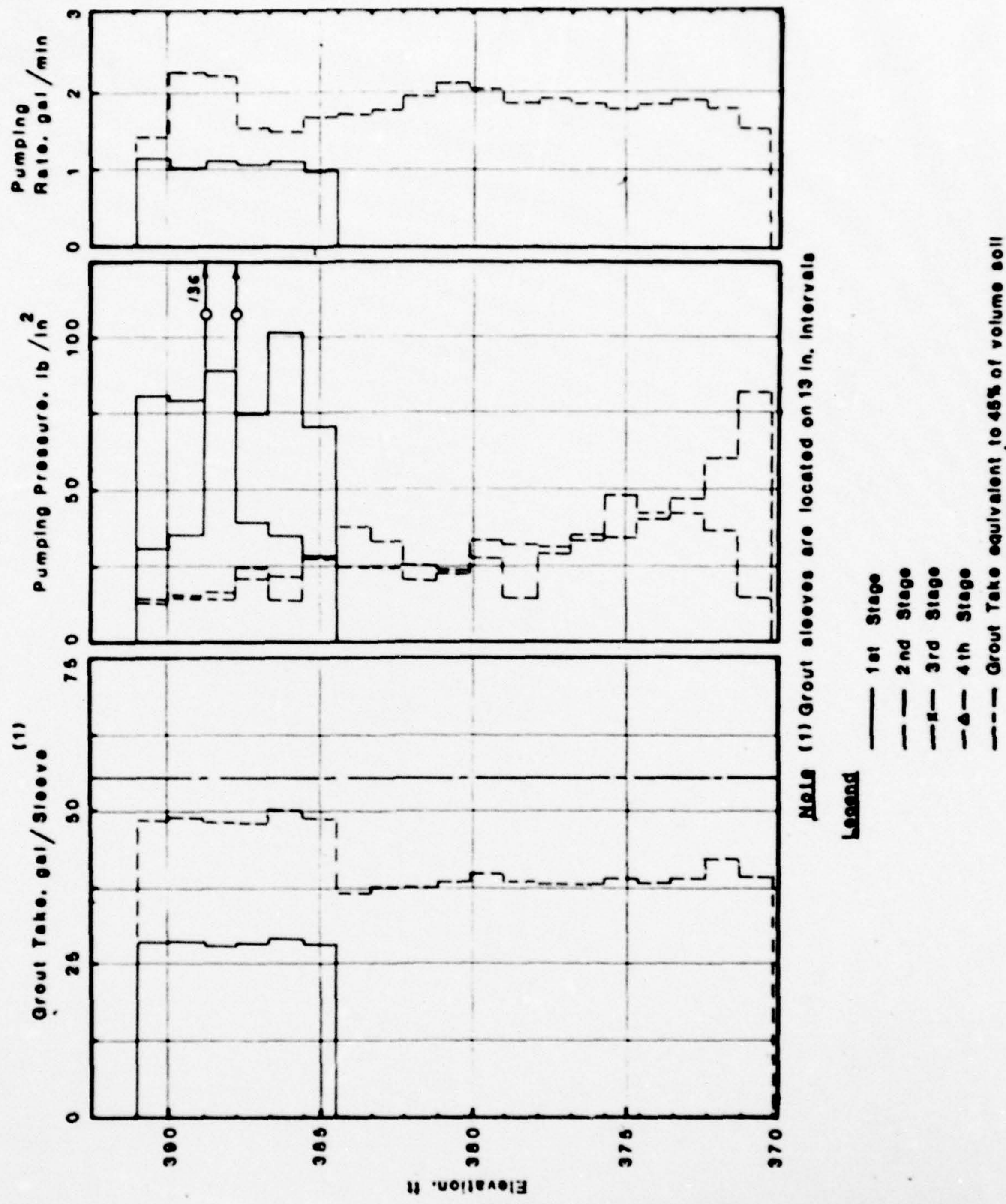
Fig. K.33

YFC825, Phase III, Vol IIIA



PILE DRIVING EFFECTS TEST PROGRAM

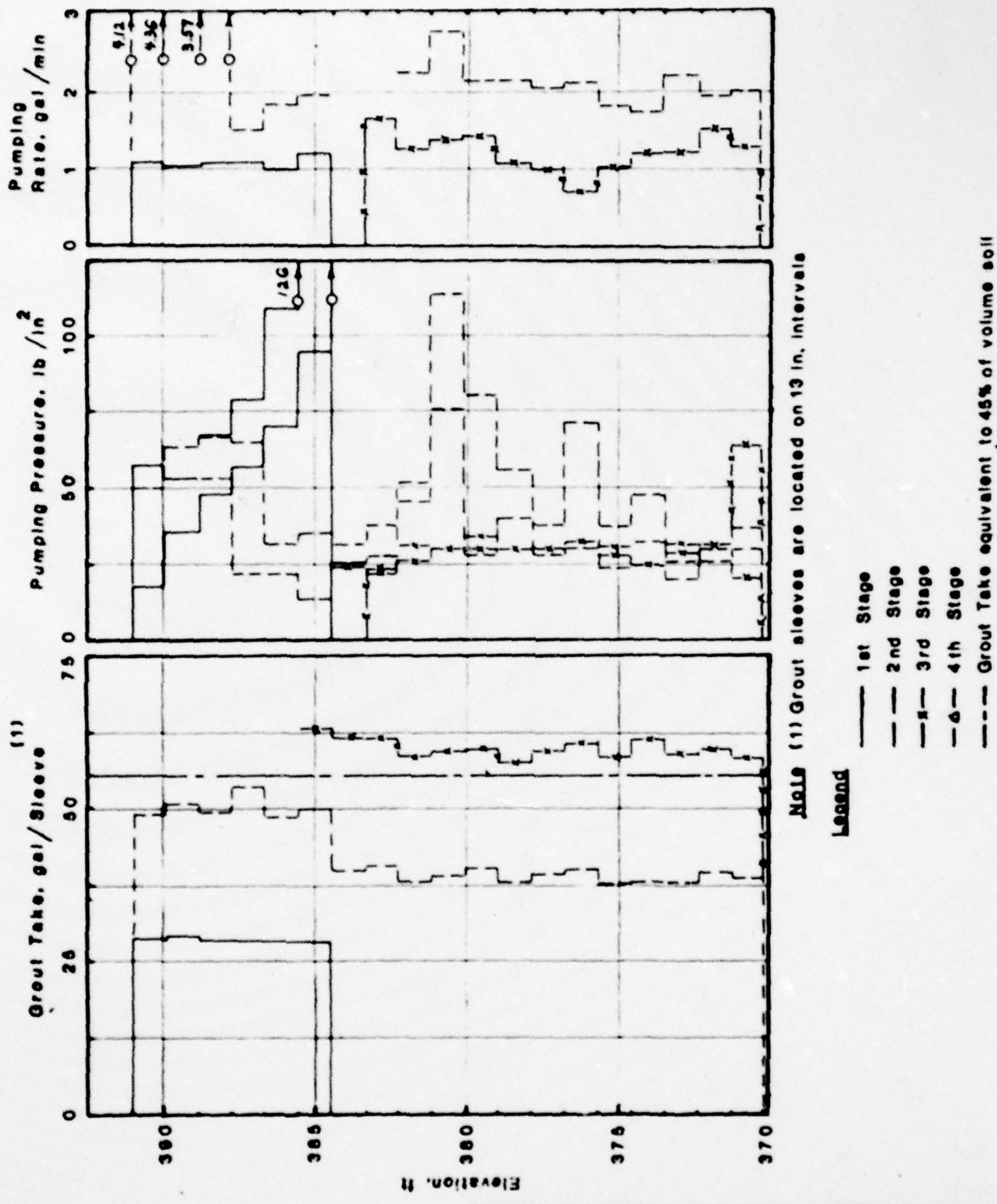
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. A-6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0065

Woodward-Clyde Consultants

77C825, Phase II; Vol III A

Fig. K.34



PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. A-7

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

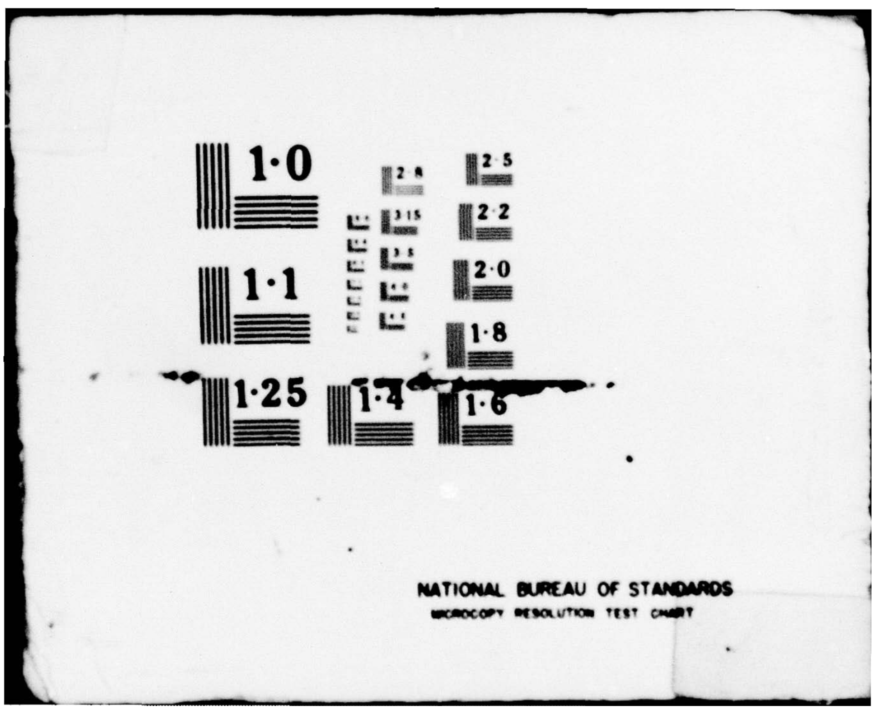
77C825, Phase III, Vol III A

Fig. K.35

AD-A076 094 WOODWARD-CLYDE CONSULTANTS CHICAGO IL F/G 13/2
RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM--ETC(U)
JUL 79 J PEREZ , D M HOLLOWAY DACW43-78-C-0005

UNCLASSIFIED NL

2 OF 6
AD-
A076094


1·0
2·8
2·5
3·15
2·2
3·5
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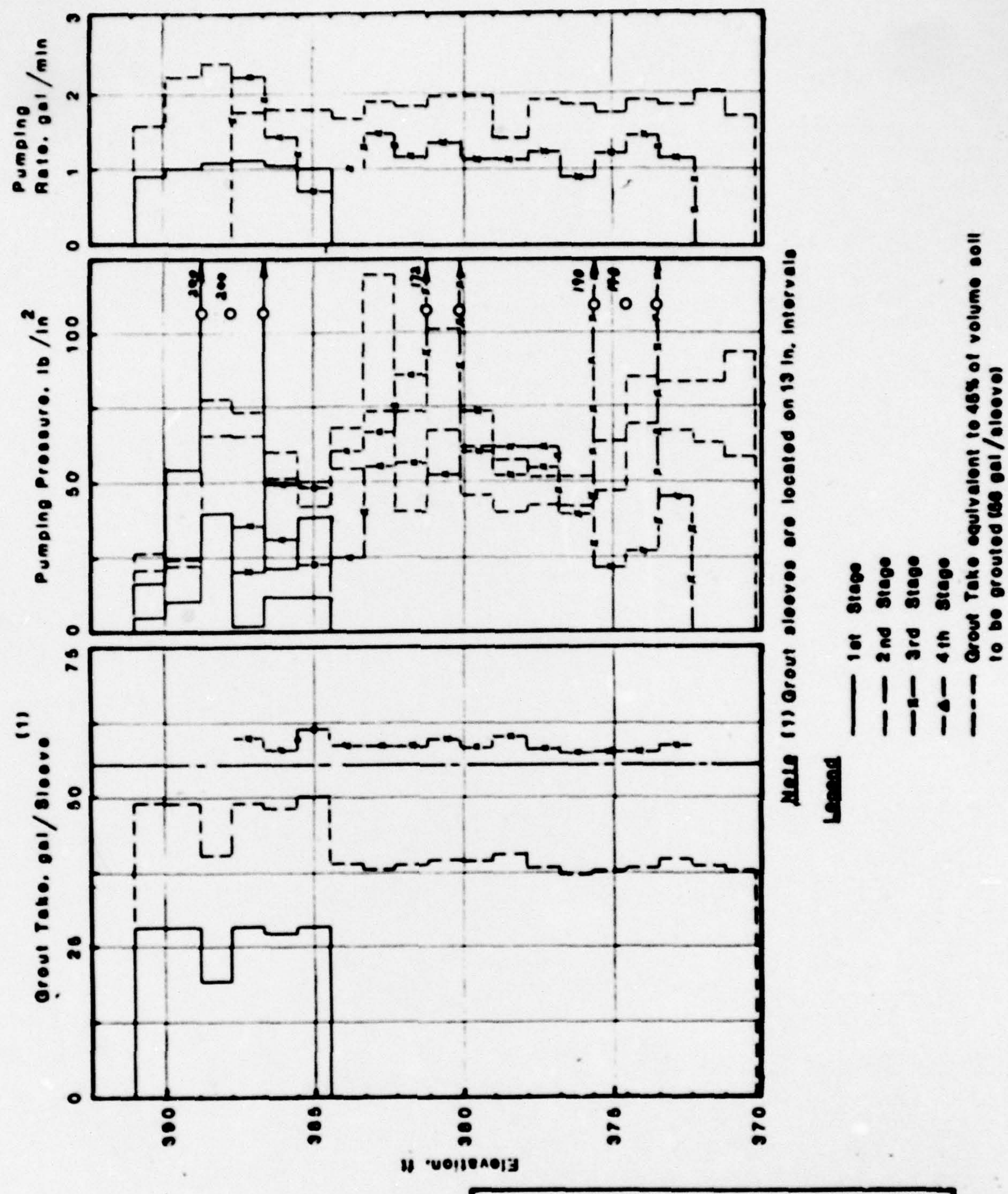
1·1
1·8
1·25
1·4
1·6
NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART



PILE DRIVING EFFECTS TEST PROGRAM

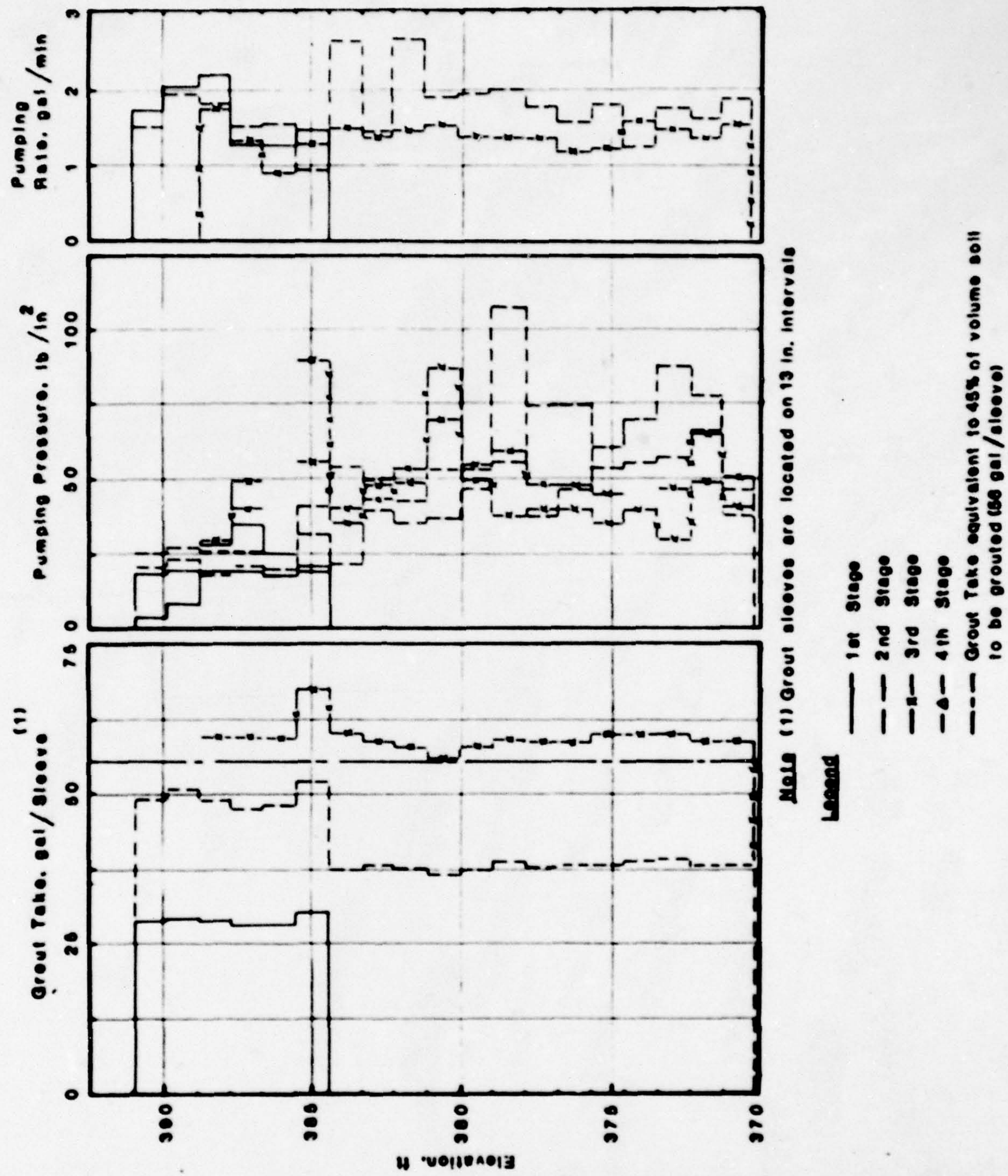
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. A-8

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0085

Woodward-Clyde Consultants

77C025 Phase III, Vol III A

Fig. K.36



PILE DRIVING EFFECTS TEST PROGRAM

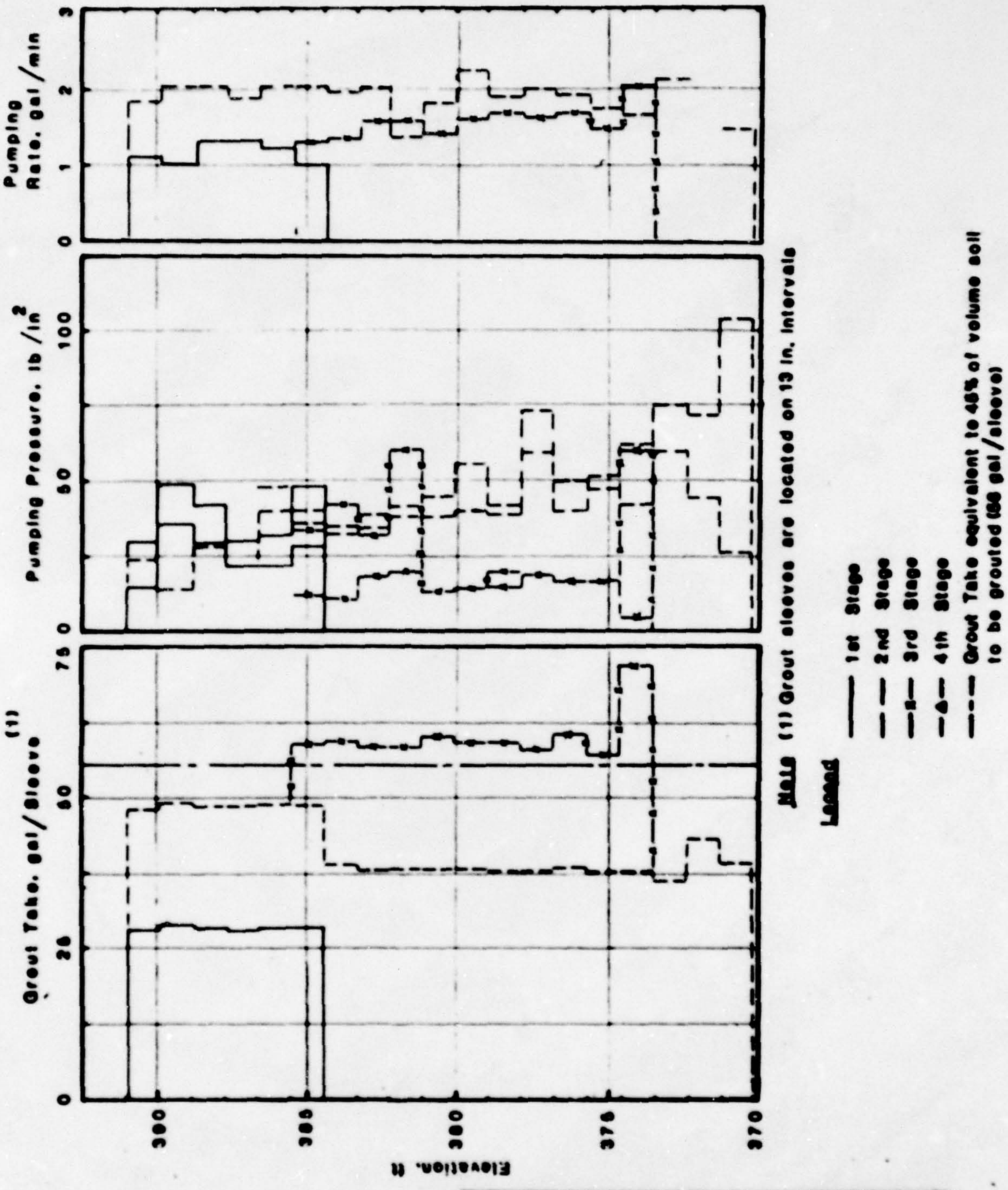
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. A-9

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

77C023 Phase II ; Vol III A

Fig. K.37



PILE DRIVING EFFECTS TEST PROGRAM

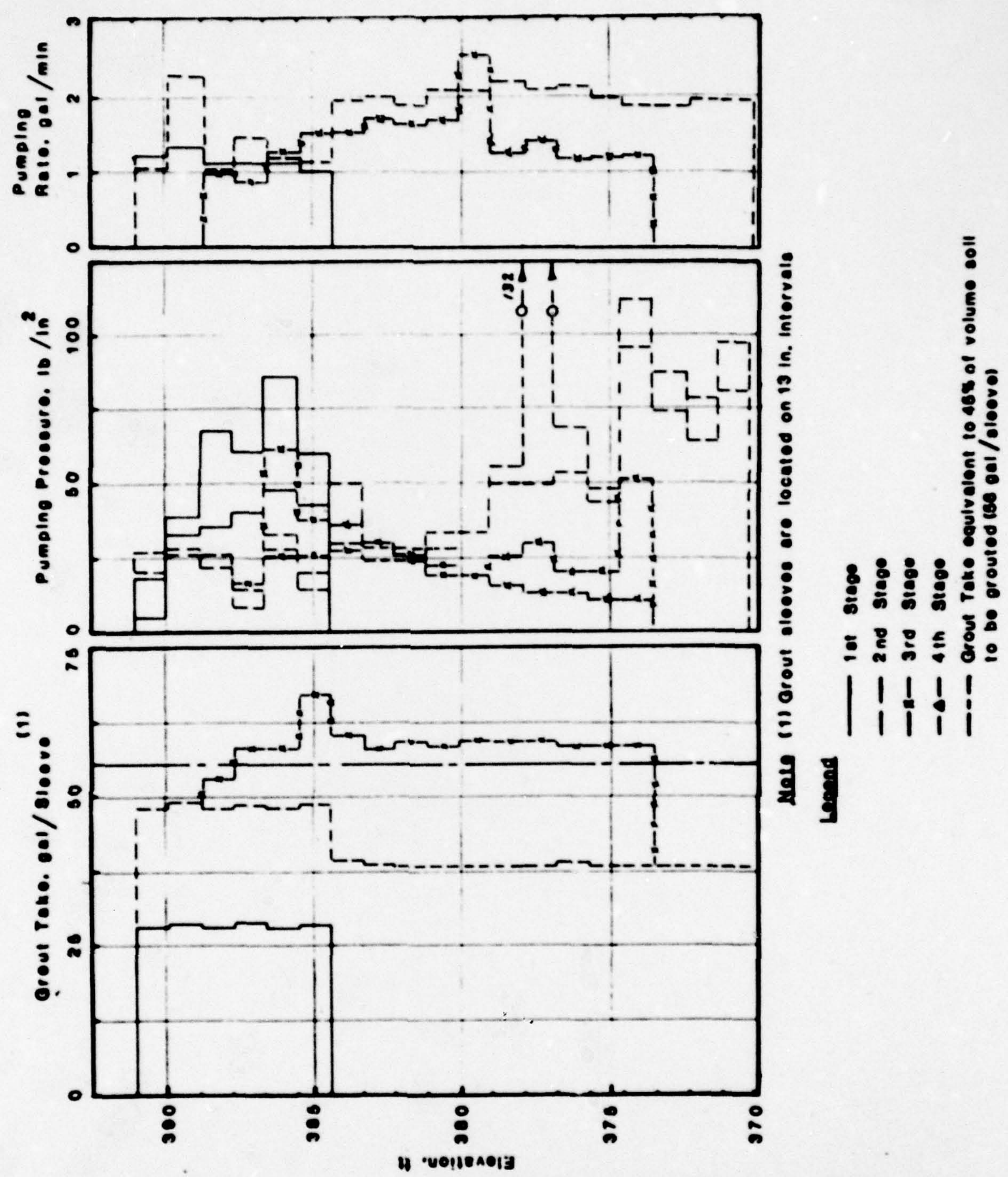
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. B-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-70-C-0000

Woodward-Clyde Consultants

YTC025, Phase III; Vol III A

Fig. K.38



PILE DRIVING EFFECTS TEST PROGRAM

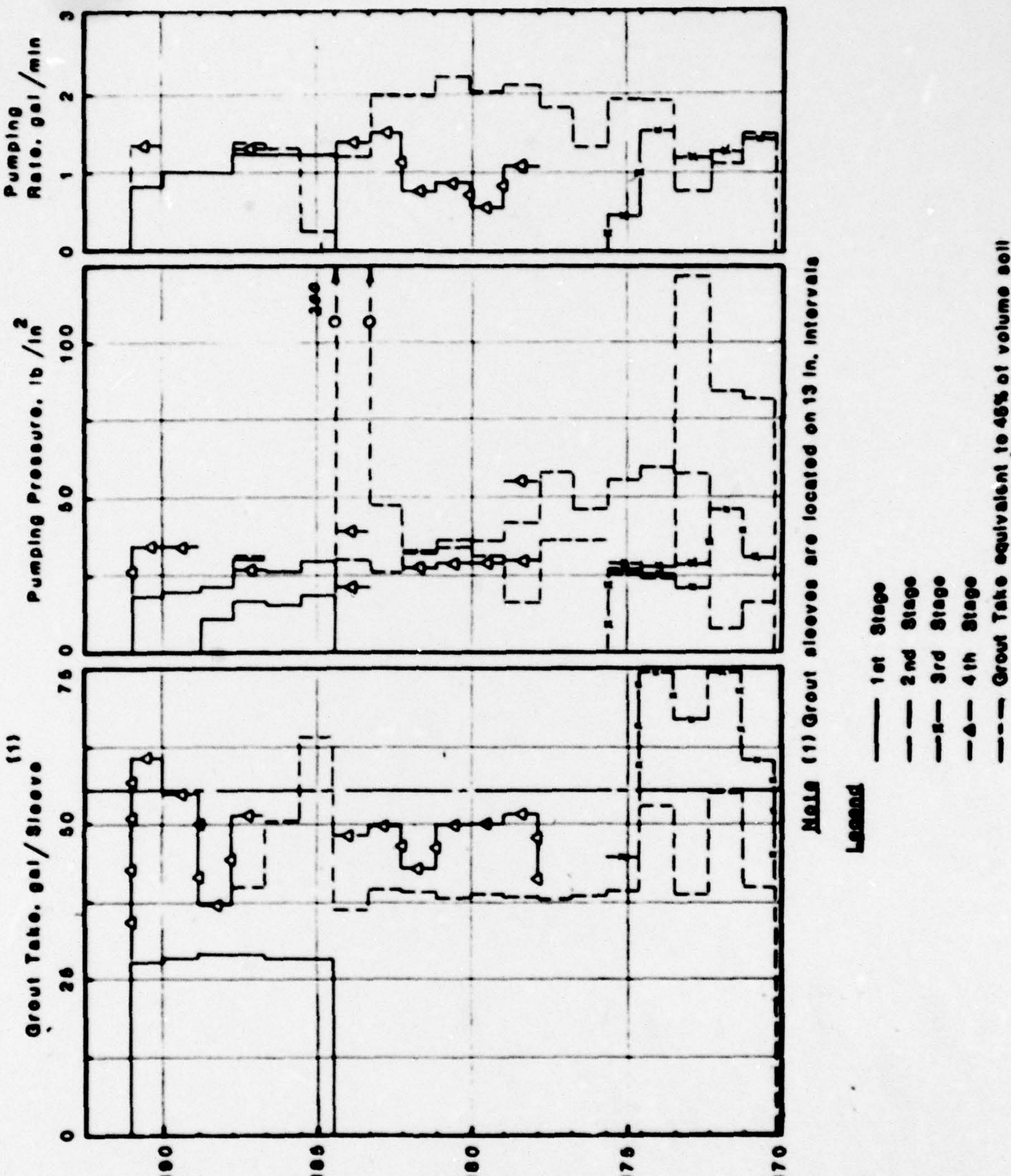
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. B-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0003

Woodward-Clyde Consultants

Phase II; Vol IIA

Fig. K. 39



PILE DRIVING EFFECTS TEST PROGRAM

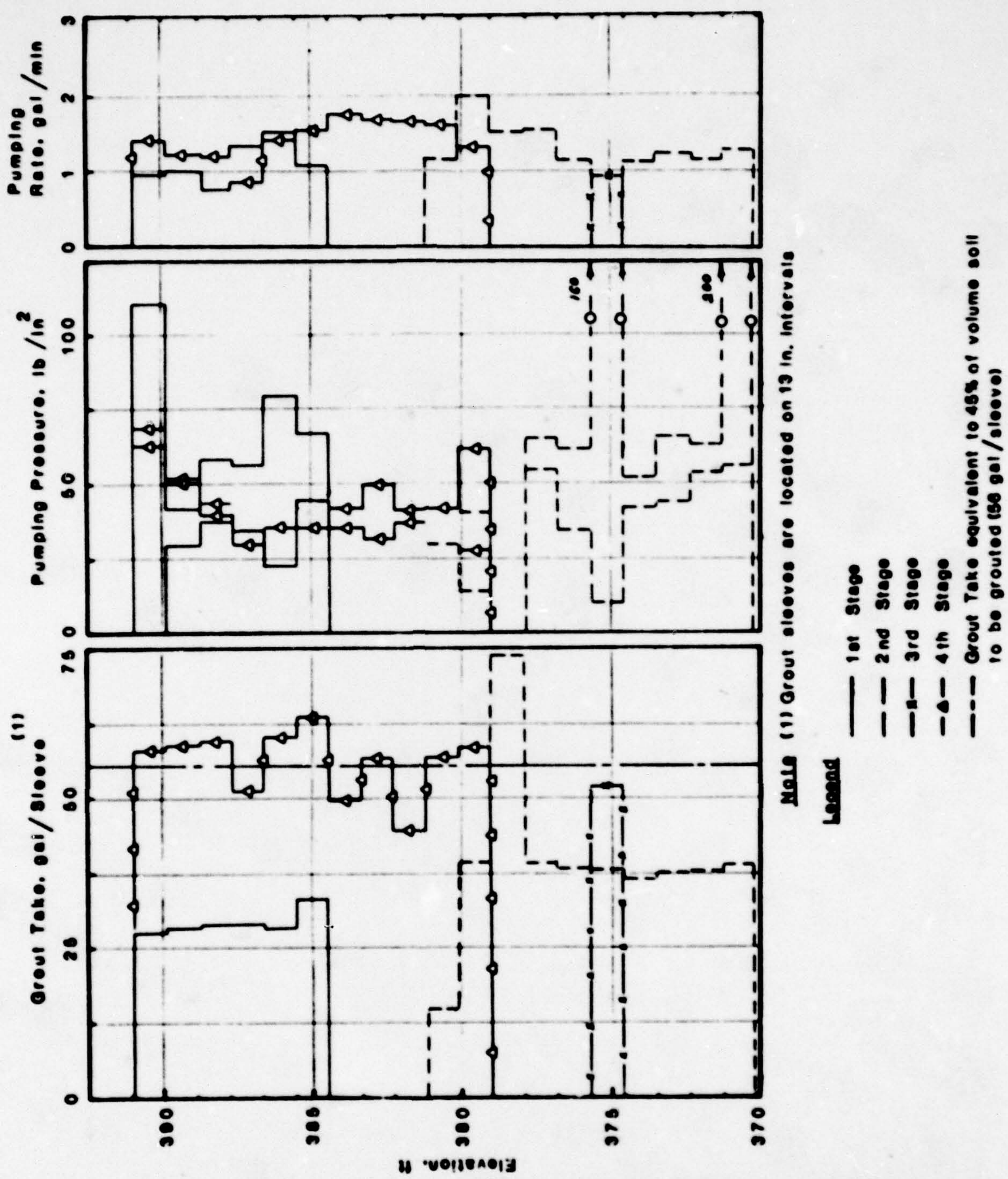
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. B-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0009

Woodward-Clyde Consultants

Fig. K.40

Y7C025, Phase II; Vol IIIA



PILE DRIVING EFFECTS TEST PROGRAM

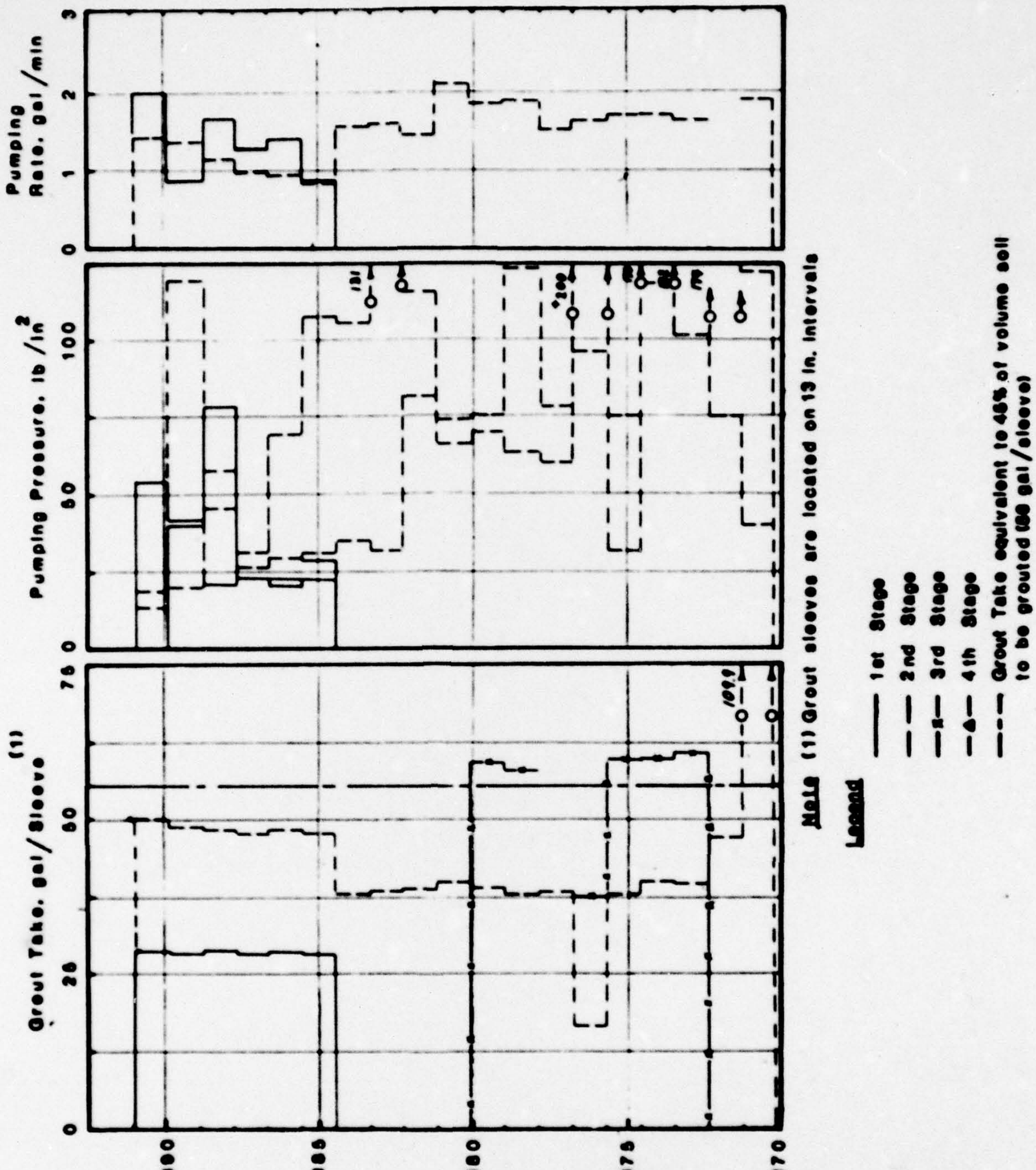
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. B-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-75-C-0003

Woodward-Clyde Consultants

WCC 75, Phase II ; Vol IIIA

Fig. K.41



PILE DRIVING EFFECTS TEST PROGRAM

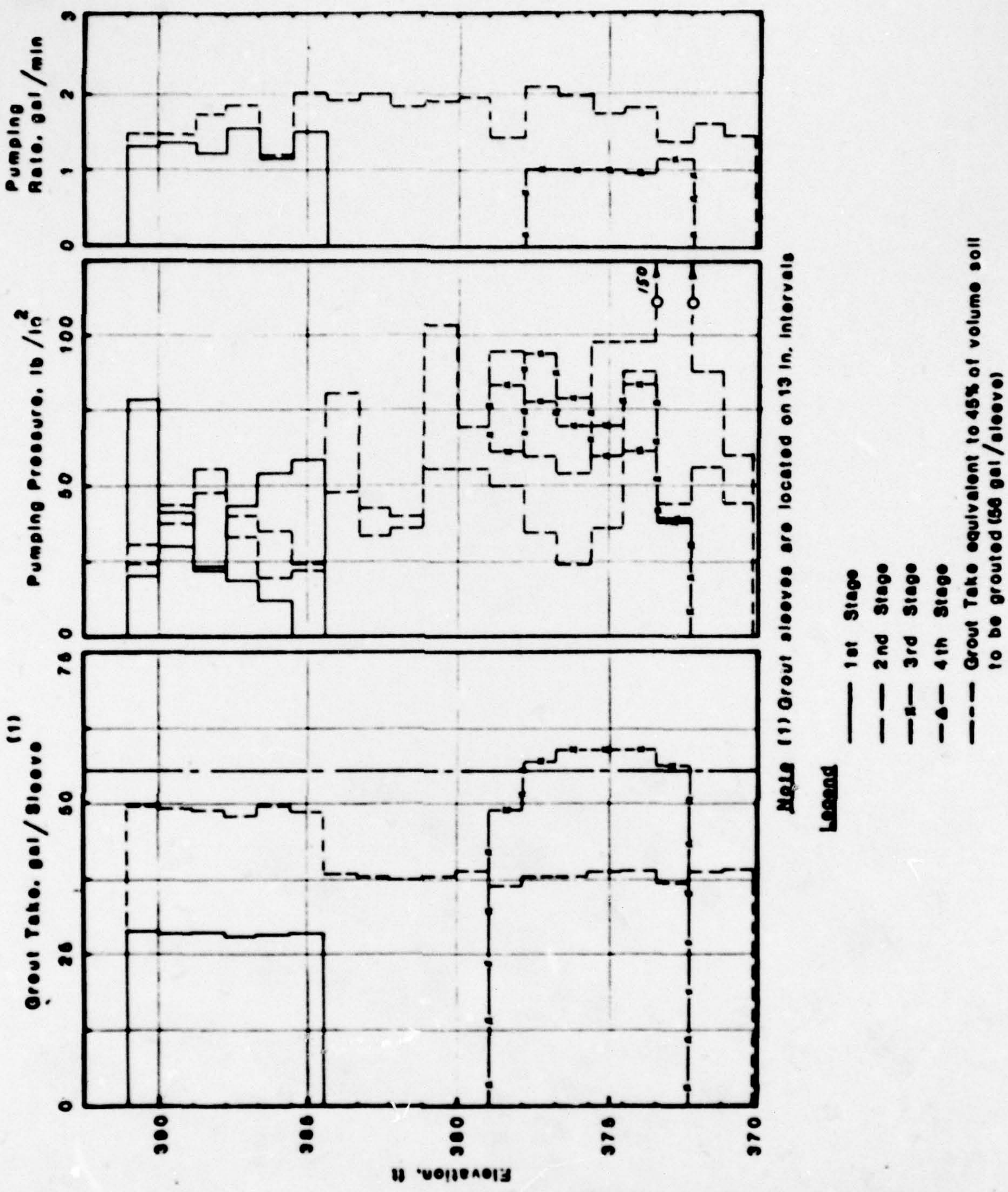
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. B-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-75-C-0005

Woodward-Clyde Consultants

77C025, Phase III; Vol IIIA

Fig. K.42



PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. B-6

FOUNDATION INVESTIGATION AND TEST PROGRAM

EXISTING LOCKS AND DAM No. 26

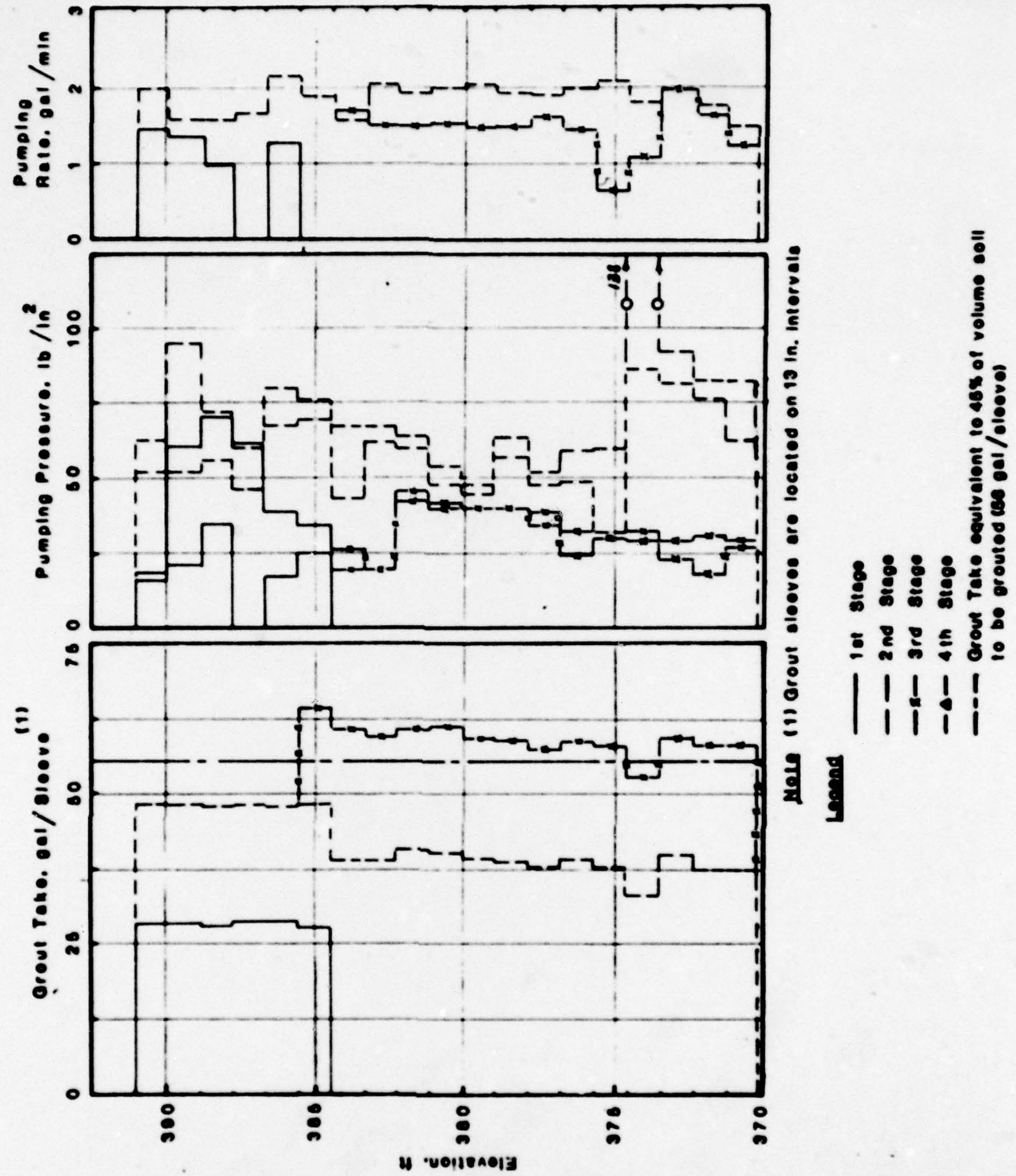
ST LOUIS DISTRICT, CORPS OF ENGINEERS.

DACW43-78-C-[illegible]

Woodward-Clyde Consultants

77C025 [illegible] II; Vol III A

Fig. K.43



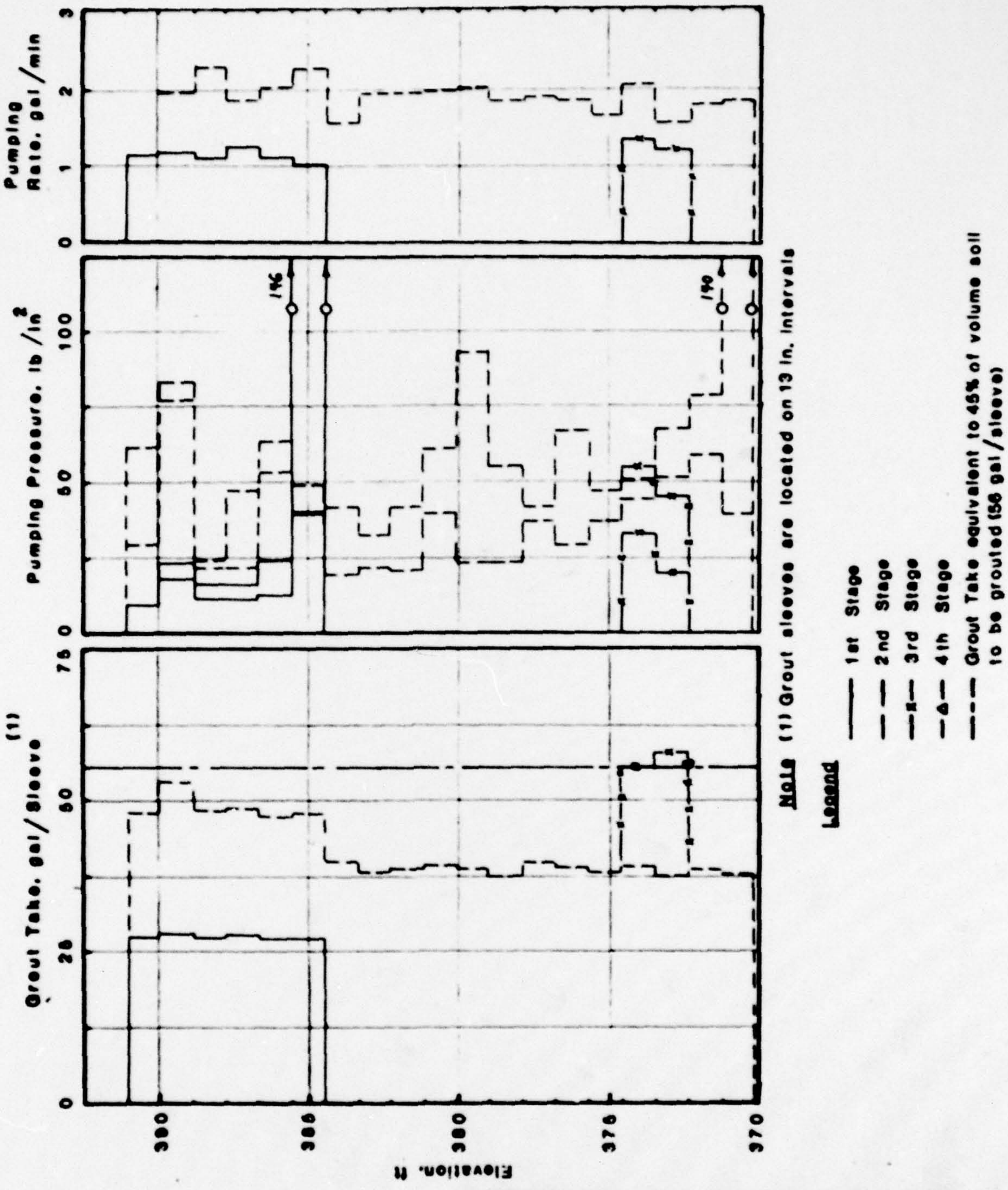
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. B-7

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants
YTC025, Phase II; Vol III A

Fig. K.44



PILE DRIVING EFFECTS TEST PROGRAM

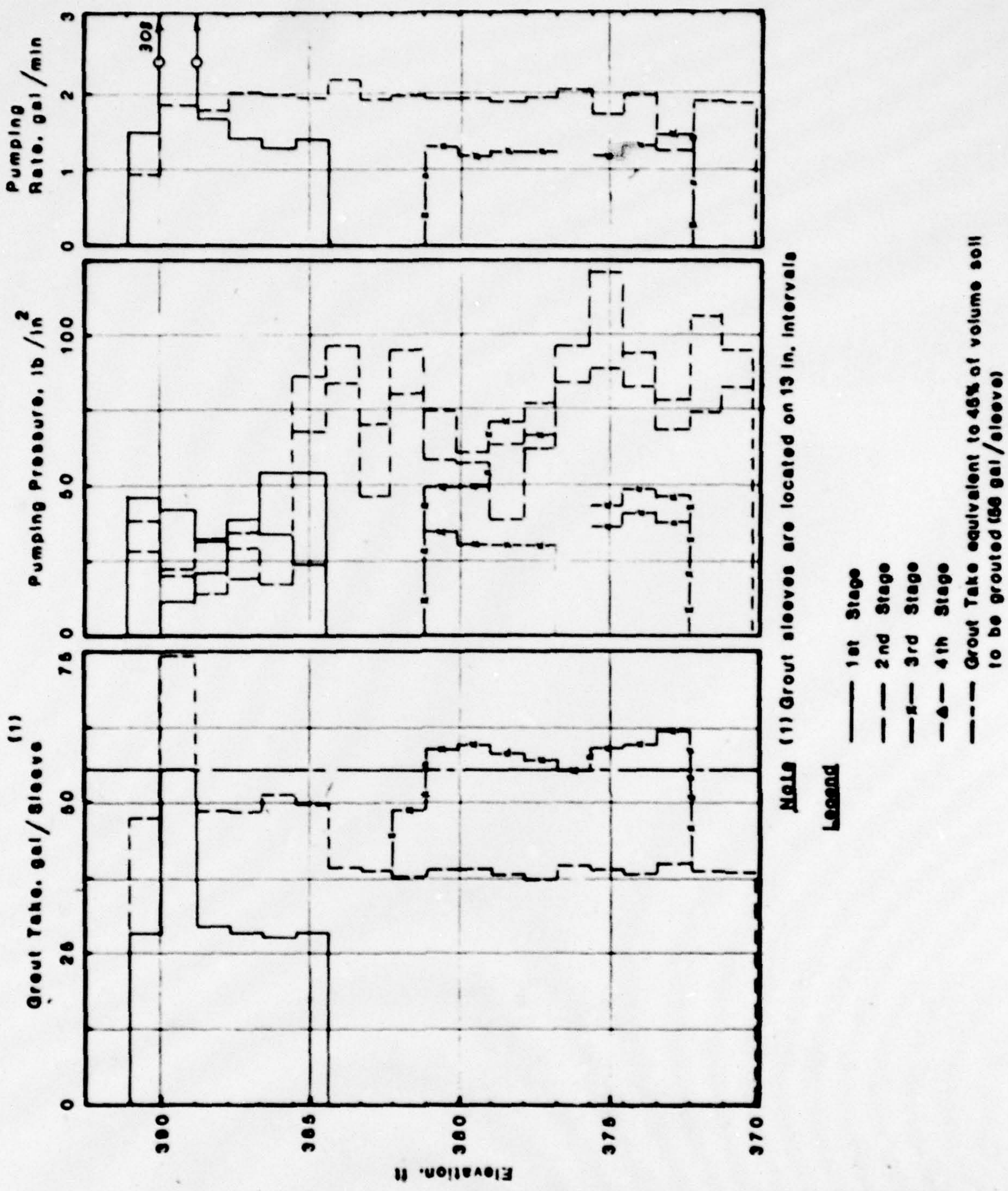
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. B-8

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

77C525, Phase III, Vol III A

Fig. K.45



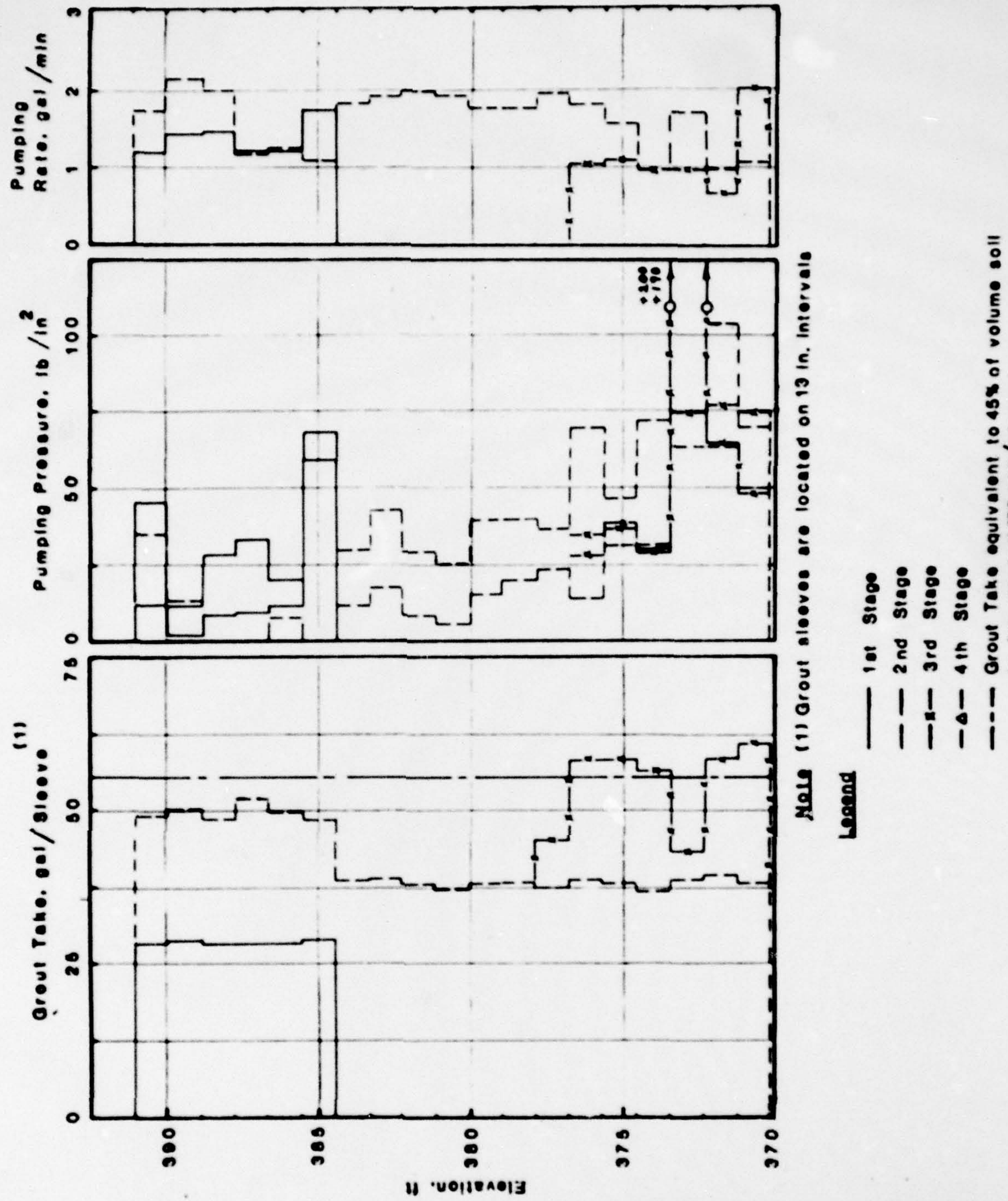
...E DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. B-9

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0085

Woodward-Clyde Consultants
77C075 Phase III; Vol IIIA

Fig. K.46



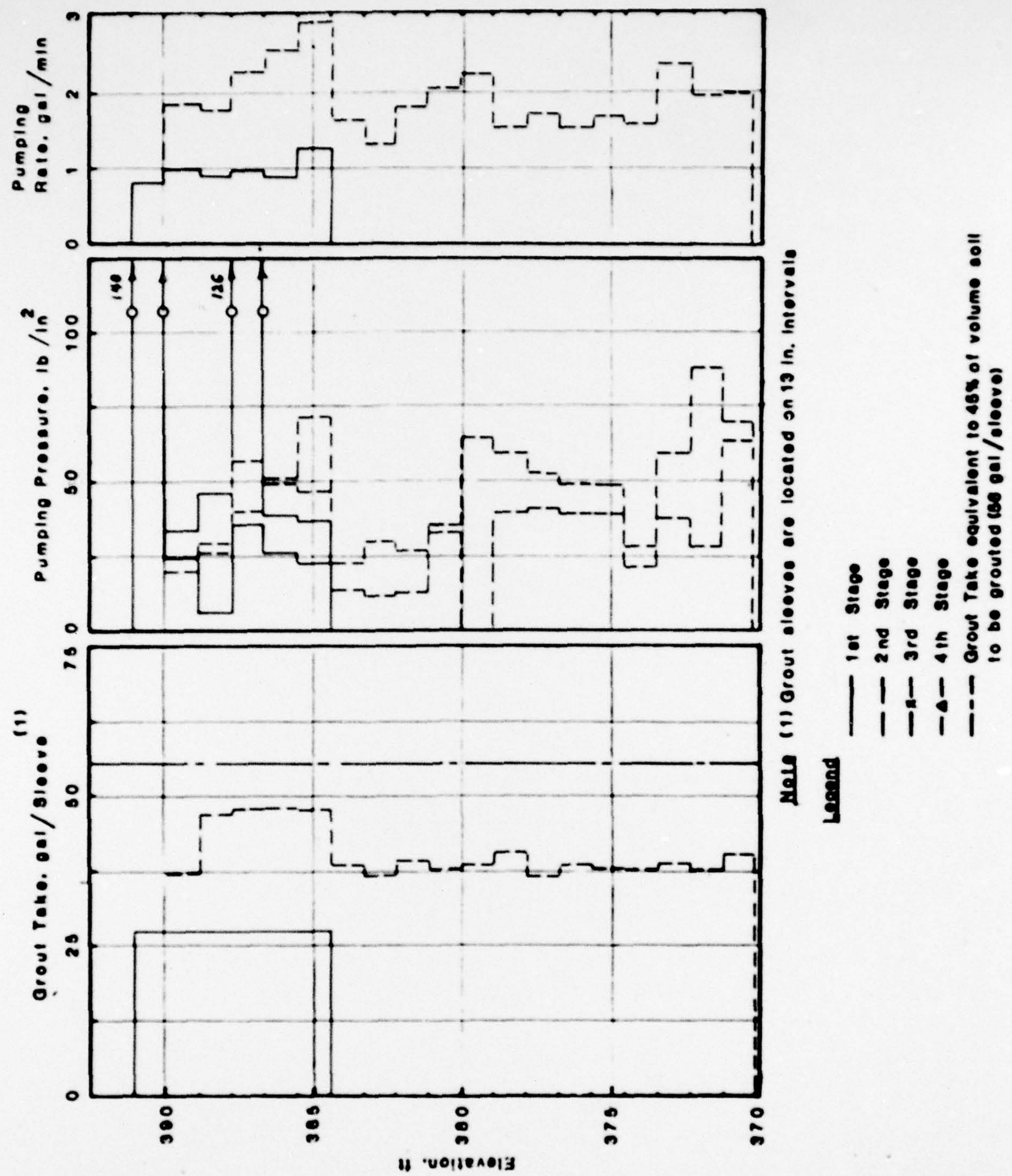
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. B-10

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.47



PILE DRIVING EFFECTS TEST PROGRAM

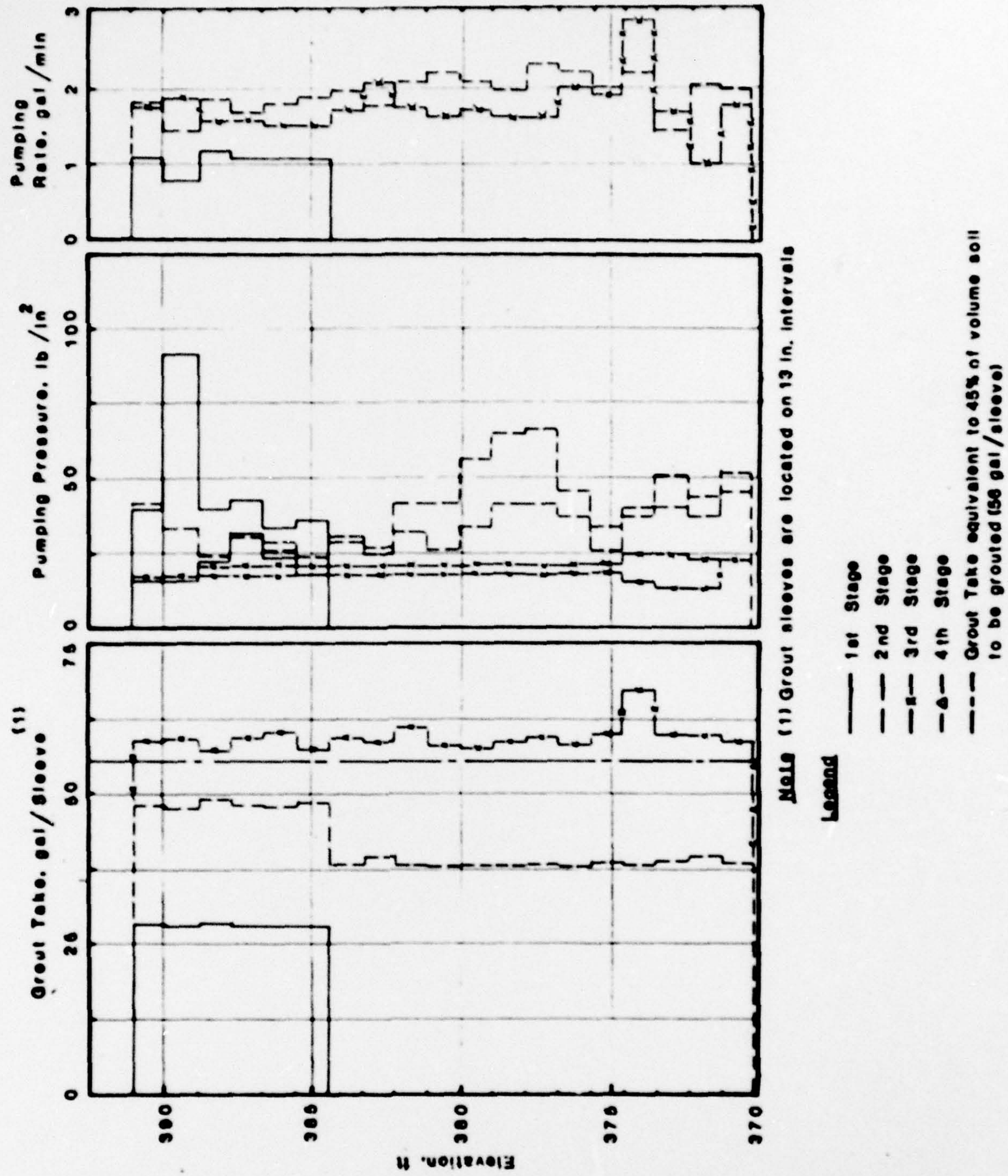
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. 8B

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

YTC825, Phase III; Vol III A

Fig. K.48



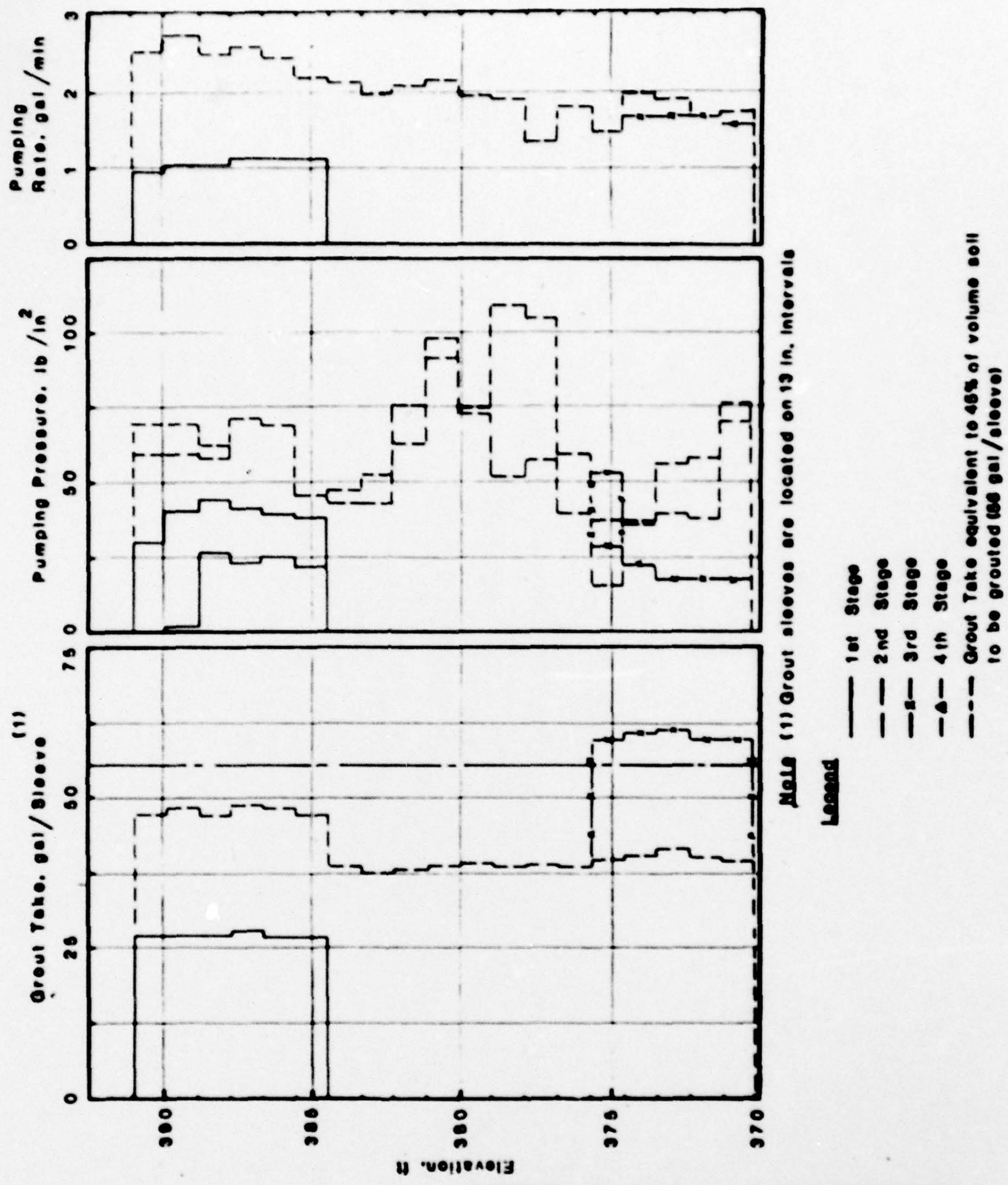
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. C-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.49



PILE DRIVING EFFECTS TEST PROGRAM

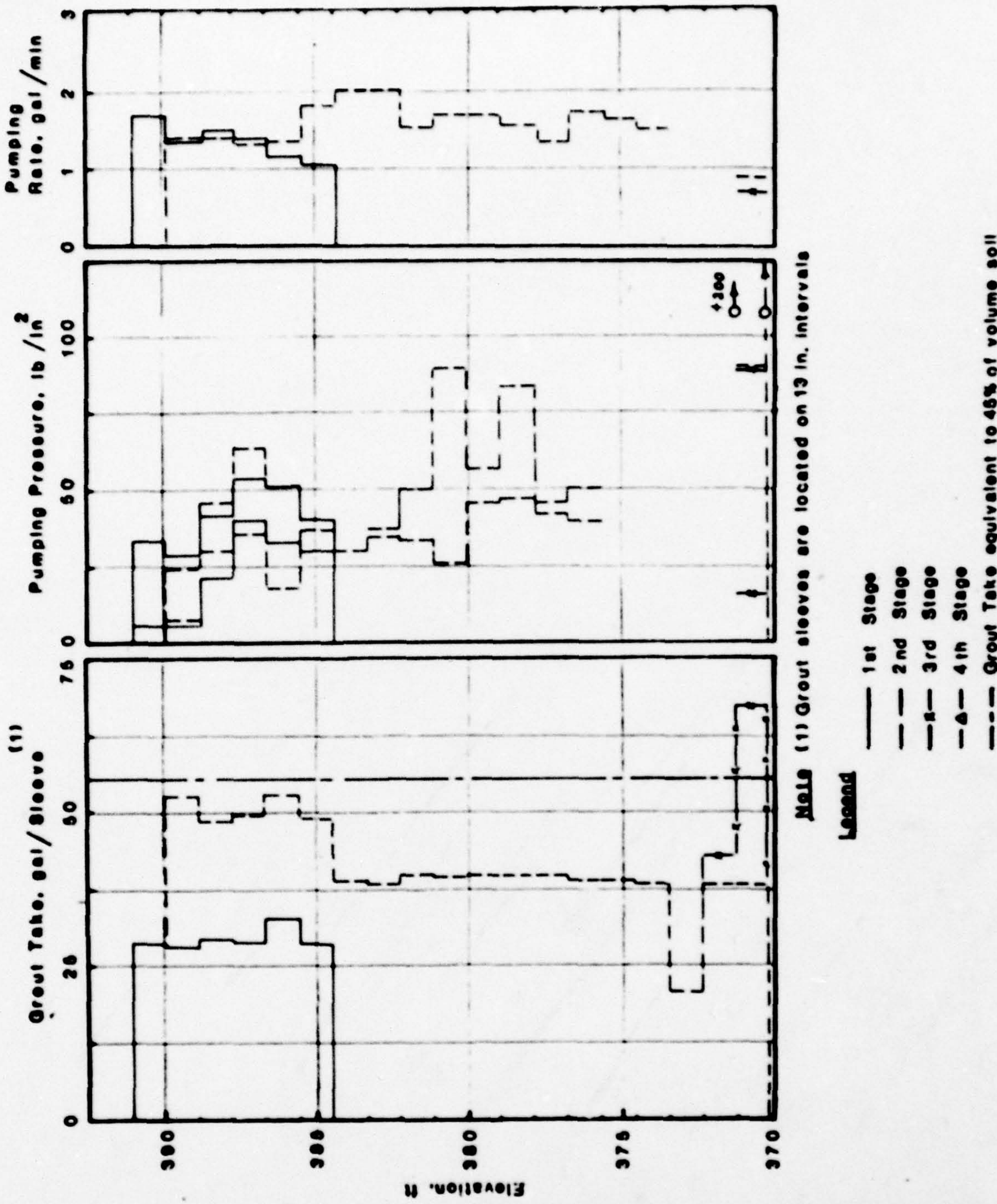
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. C-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-70-C-0005

Woodward-Clyde Consultants

VFC039, Phase III, Vol III A

Fig. K.50



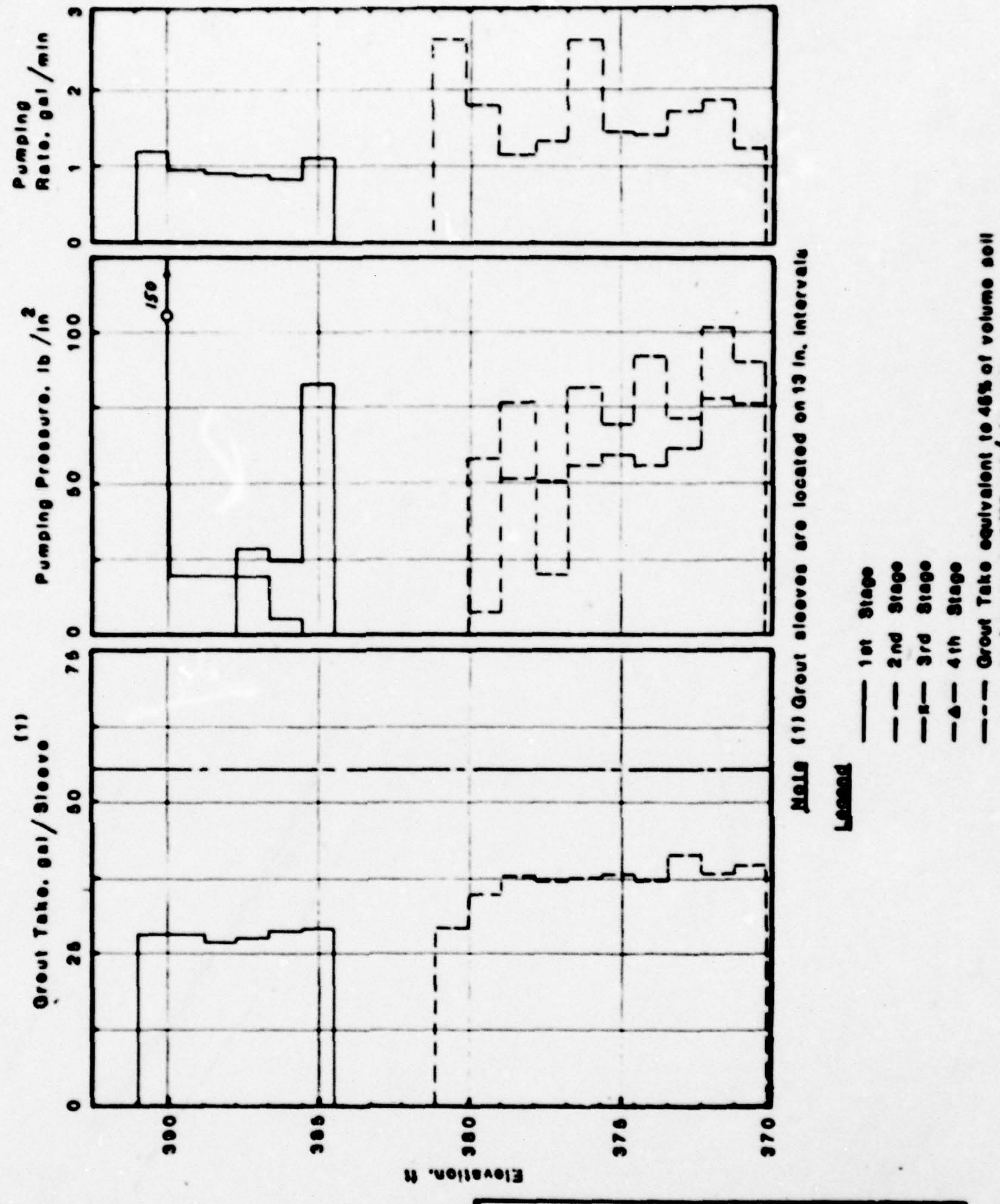
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. C-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.51



PILE DRIVING EFFECTS TEST PROGRAM

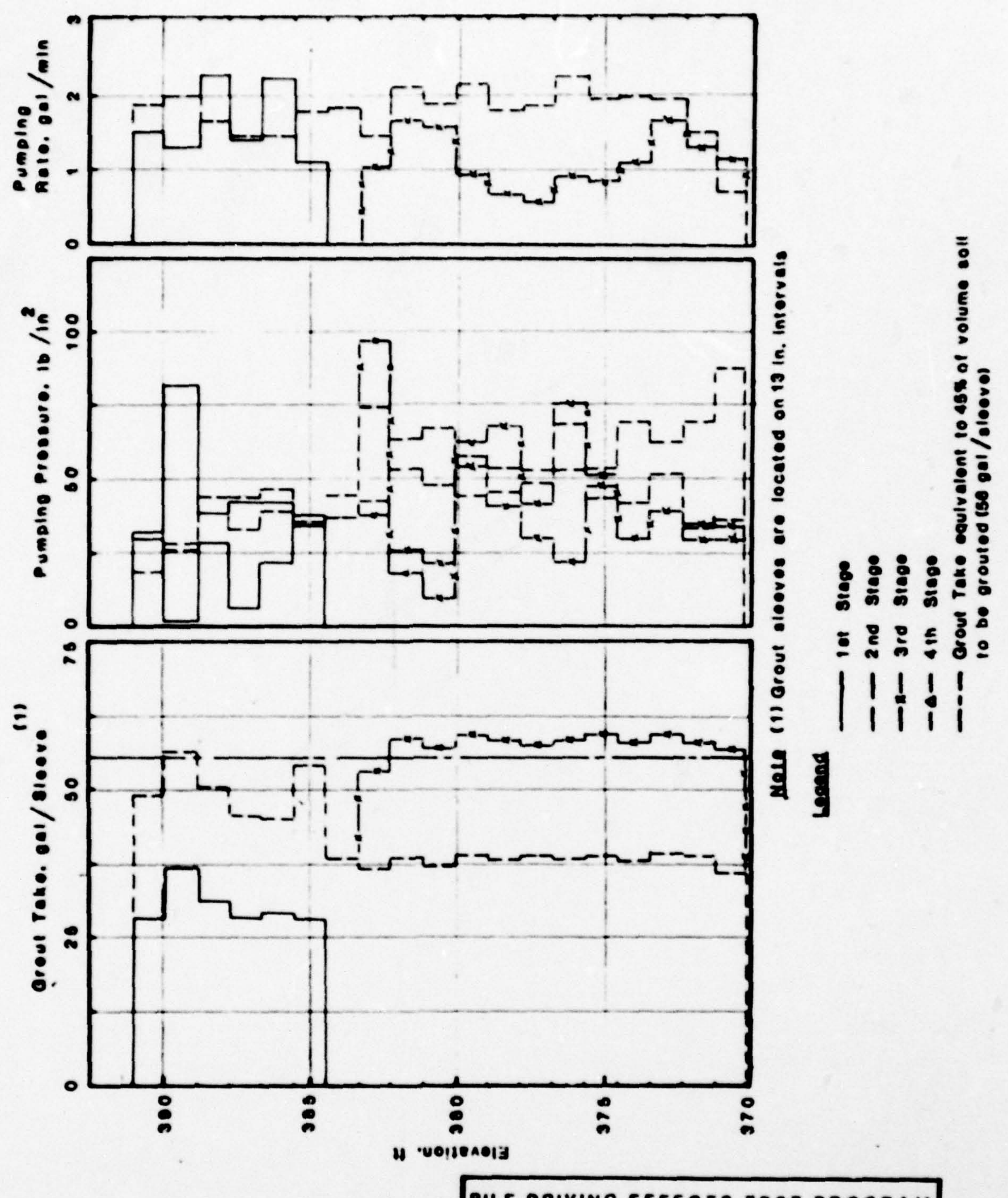
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. C-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

77C029, Phase III, IIIA

Fig. K.52



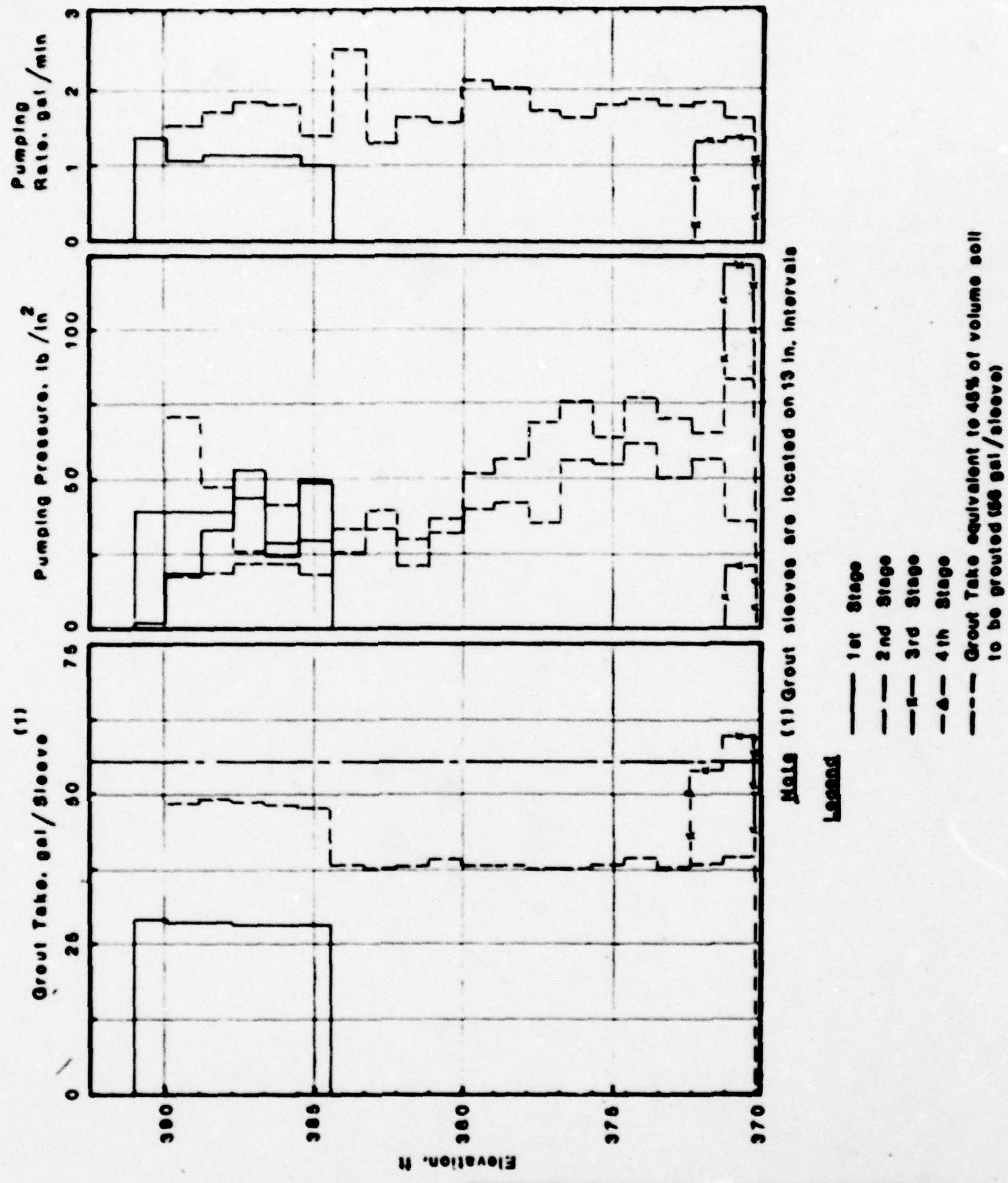
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. C-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.53



PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. C-6

FOUNDATION INVESTIGATION AND TEST PROGRAM

EXISTING LOCKS AND DAM No. 26

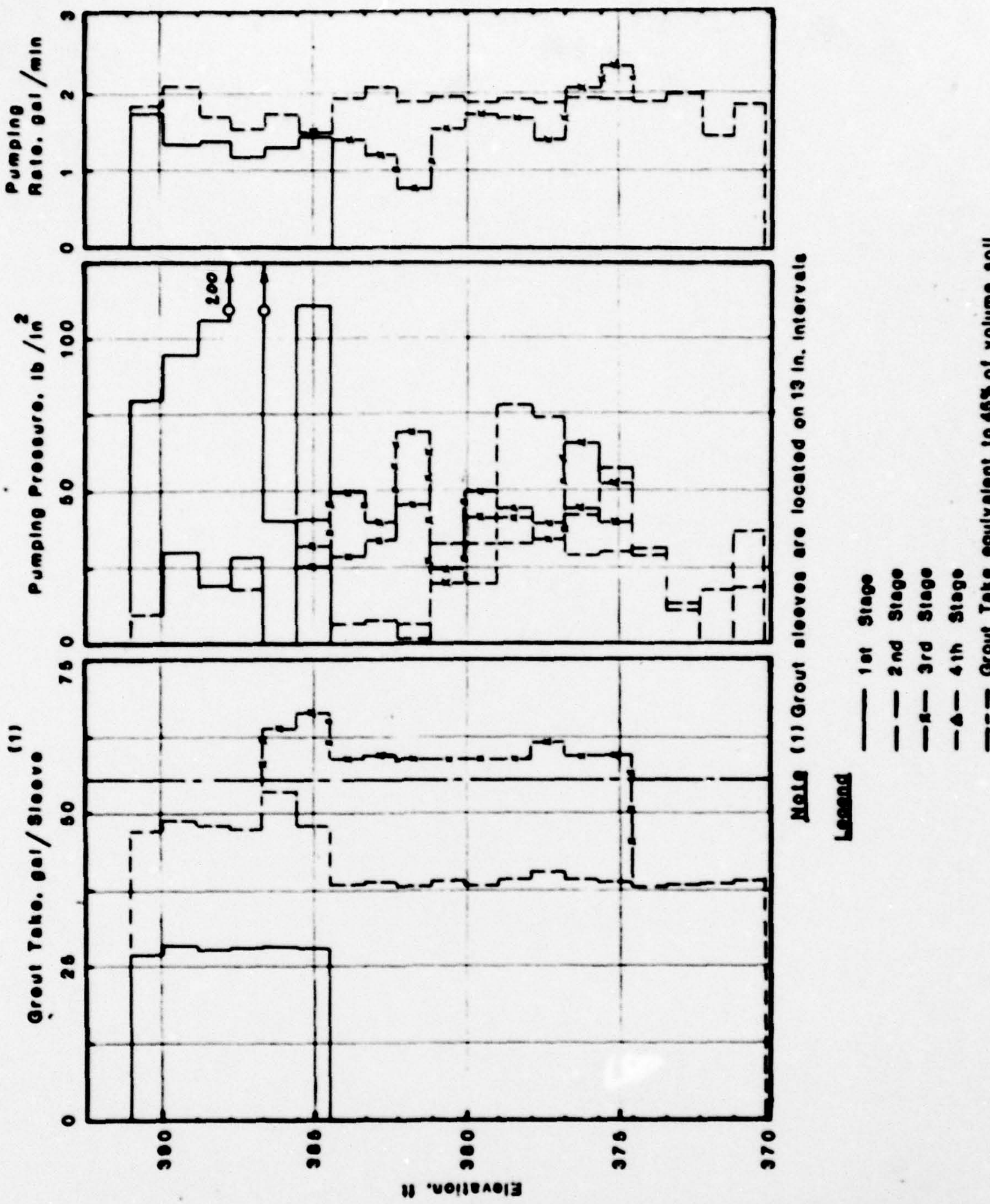
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.

DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.54

VTC025, Phase II; Vol IIIA



PILE DRIVING EFFECTS TEST PROGRAM

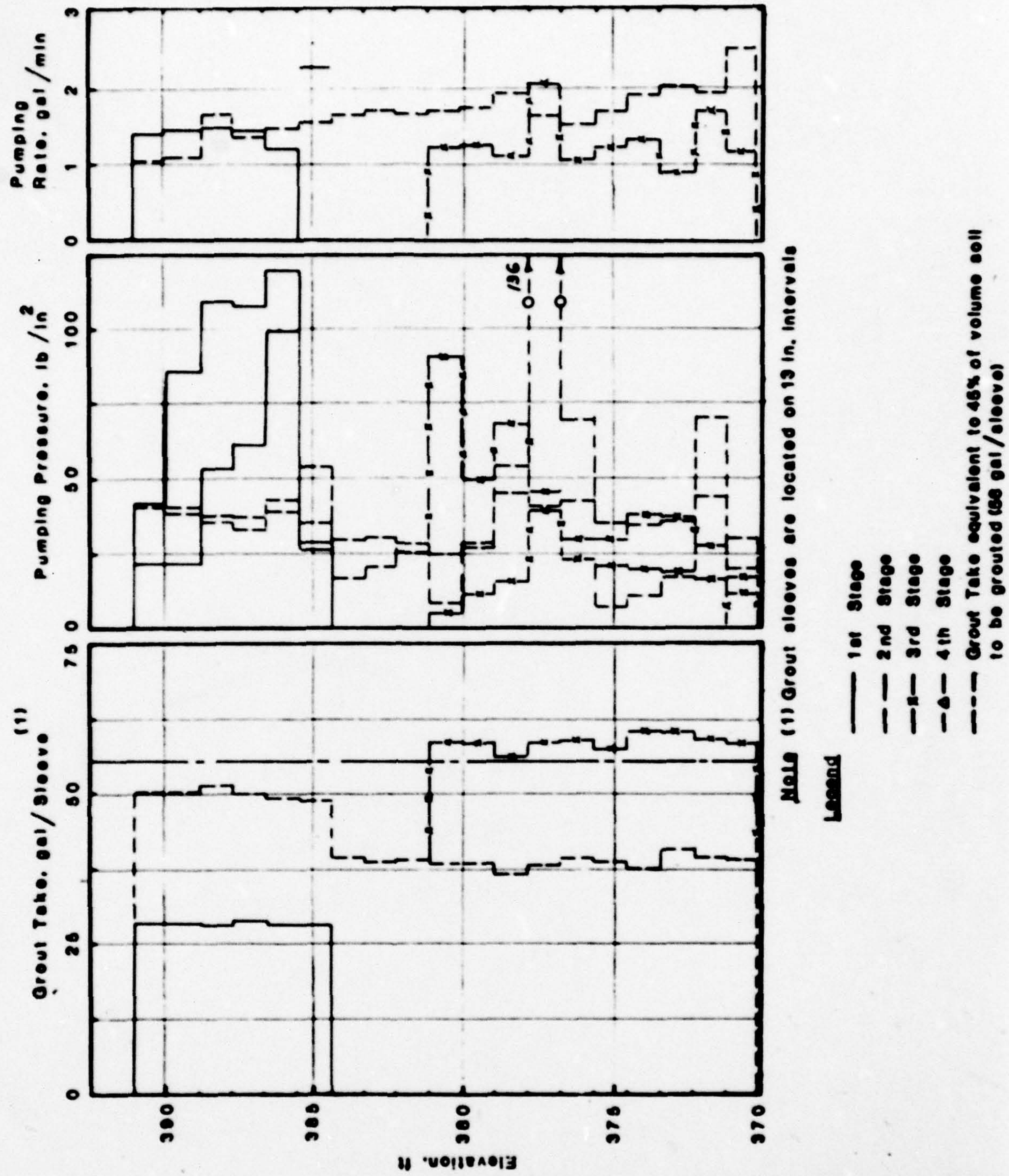
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. C-7

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.55

YYC035, Phase III; Vol III A



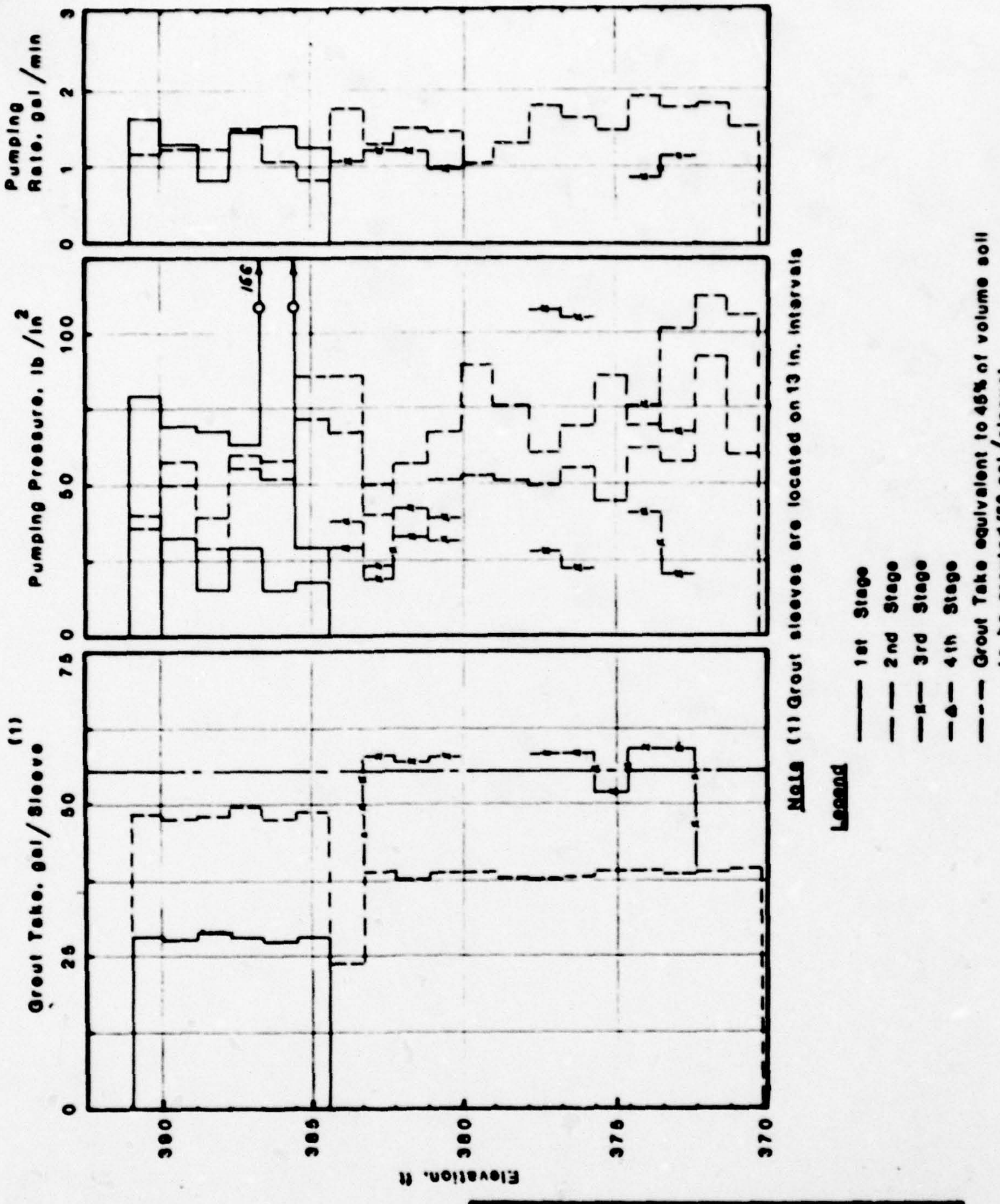
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. C-8

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants
77C025, Phase II ; Vol III A

Fig. K.56



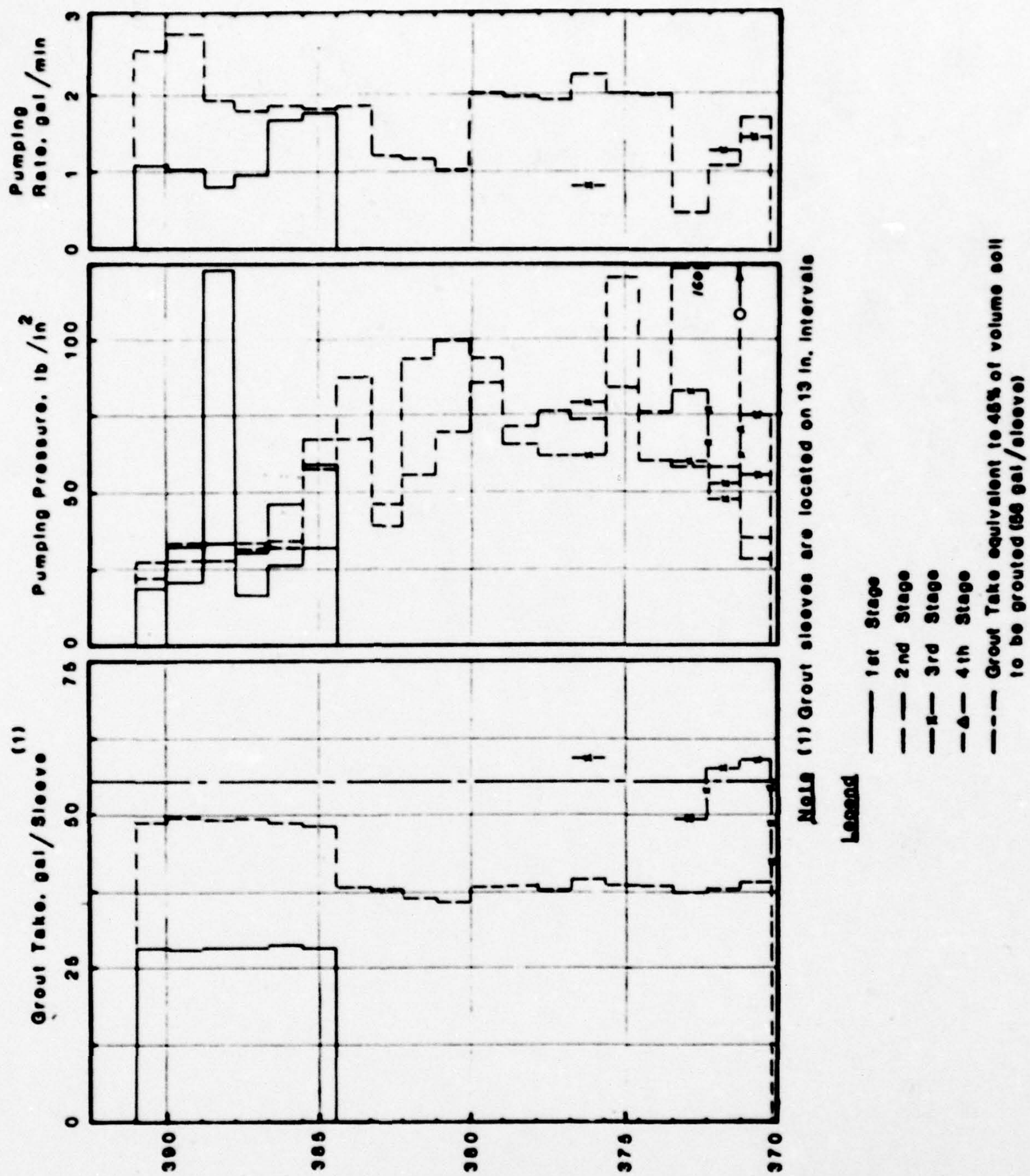
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. C-9

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0009

Woodward-Clyde Consultants
VTC825, Phase III, Vol III A

Fig. K.67



PILE DRIVING EFFECTS TEST PROGRAM

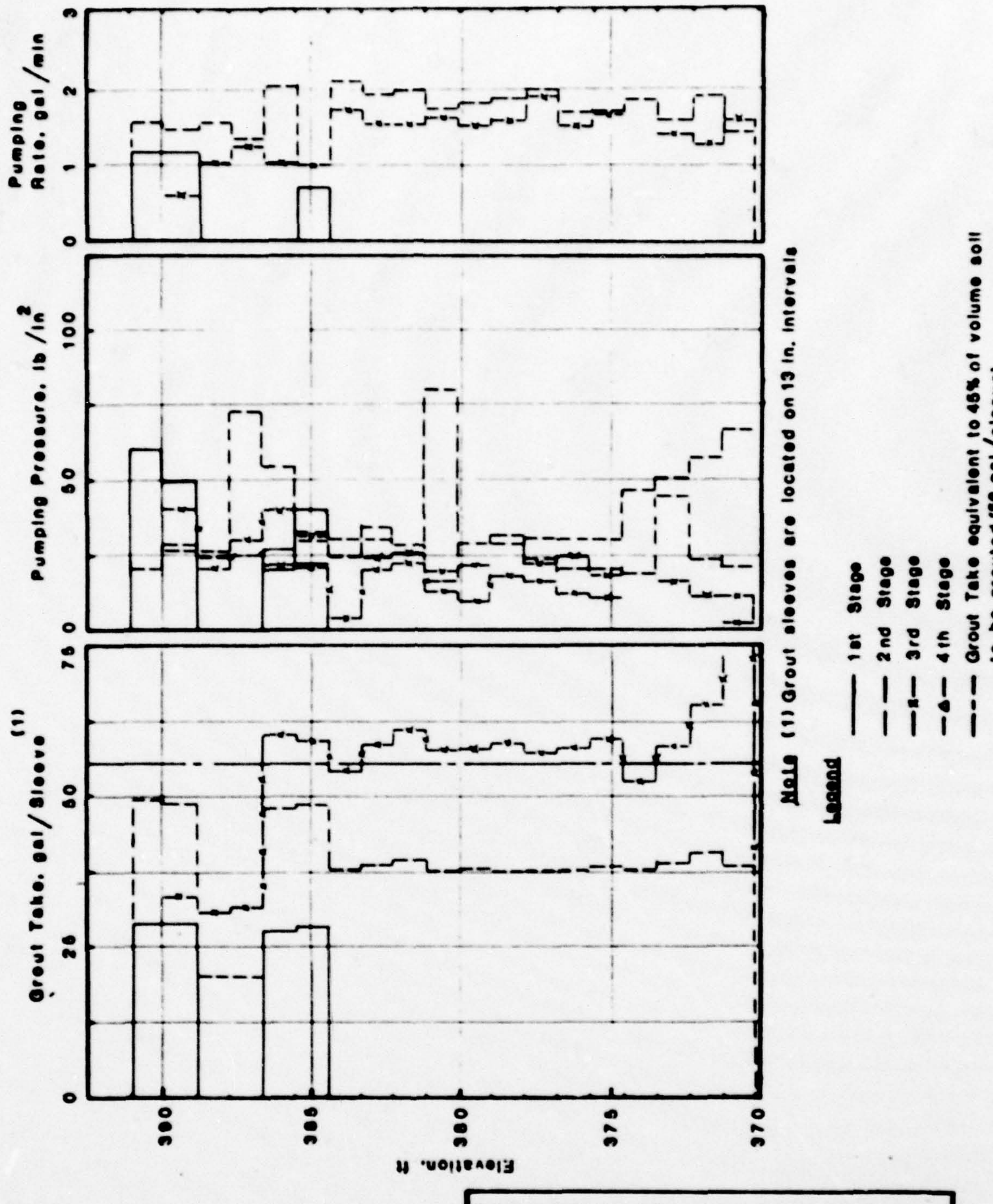
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. C-10

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

77C925, Phase II, V, VIII A

Fig. K.58



PILE DRIVING EFFECTS TEST PROGRAM

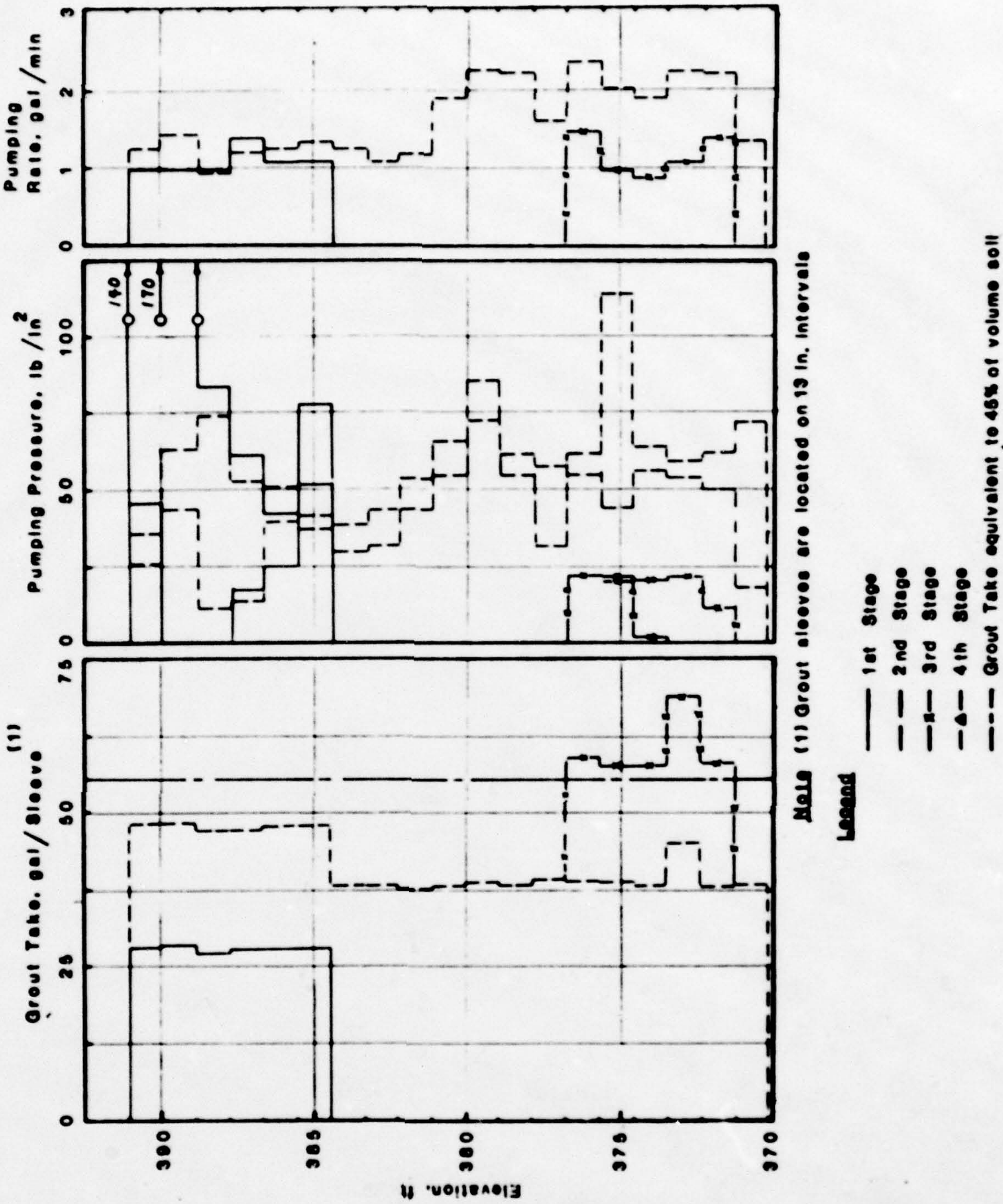
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. D-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0003

Woodward-Clyde Consultants

77C829, Phase II, Vol IIIA

Fig. K.59



PILE DRIVING EFFECTS TEST PROGRAM

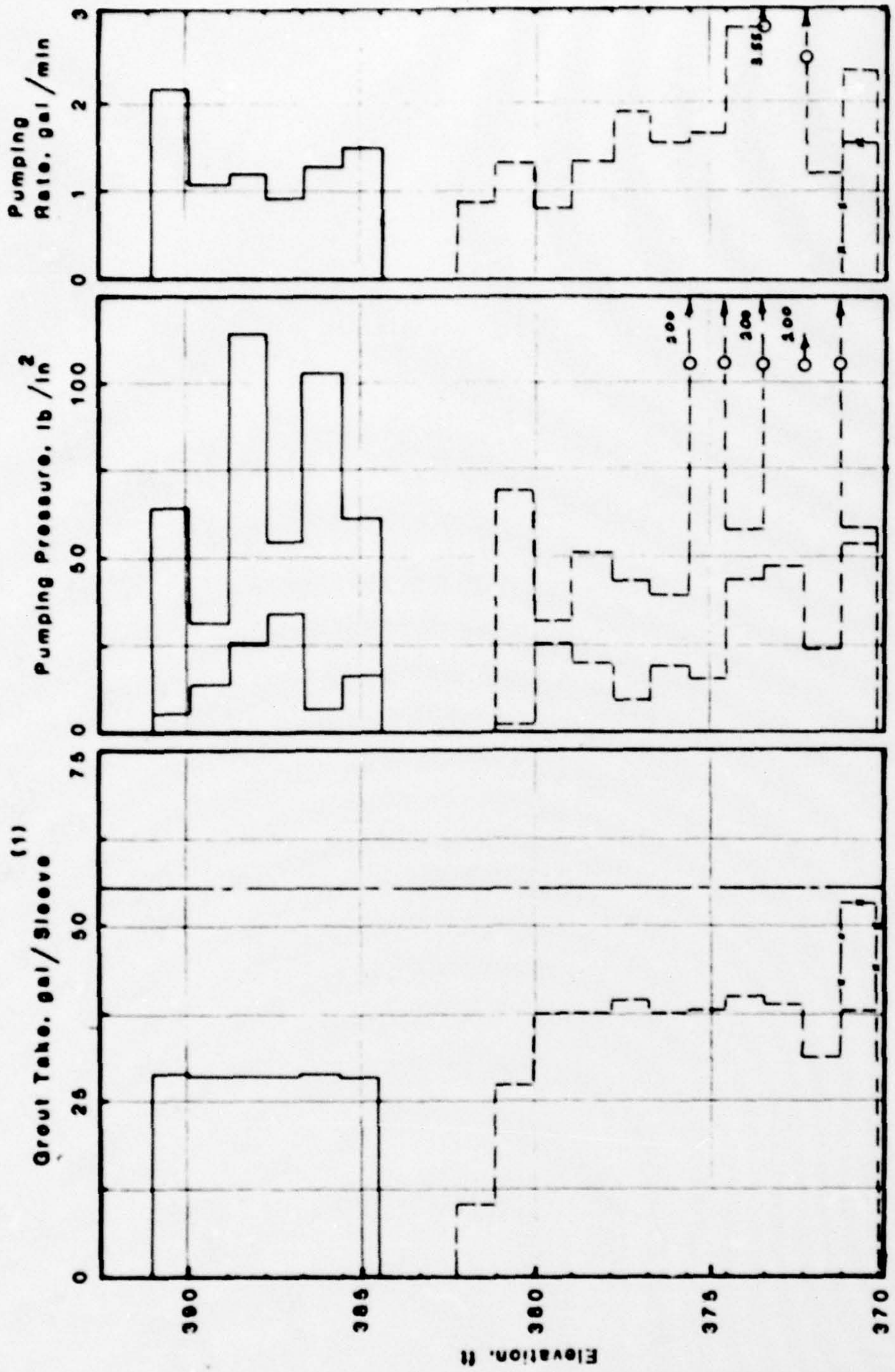
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. D-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.60

VFC025, Phase III, K1 IIIA



Note (1) Grout sleeves are located on 13 in. intervals

Legend
—— 1st Stage
– – 2nd Stage
—x— 3rd Stage
—Δ— 4th Stage
–·–· Grout Take equivalent to 45% of volume soil to be grouted (56 gal/sleeve)

PILE DRIVING EFFECTS TEST PROGRAM

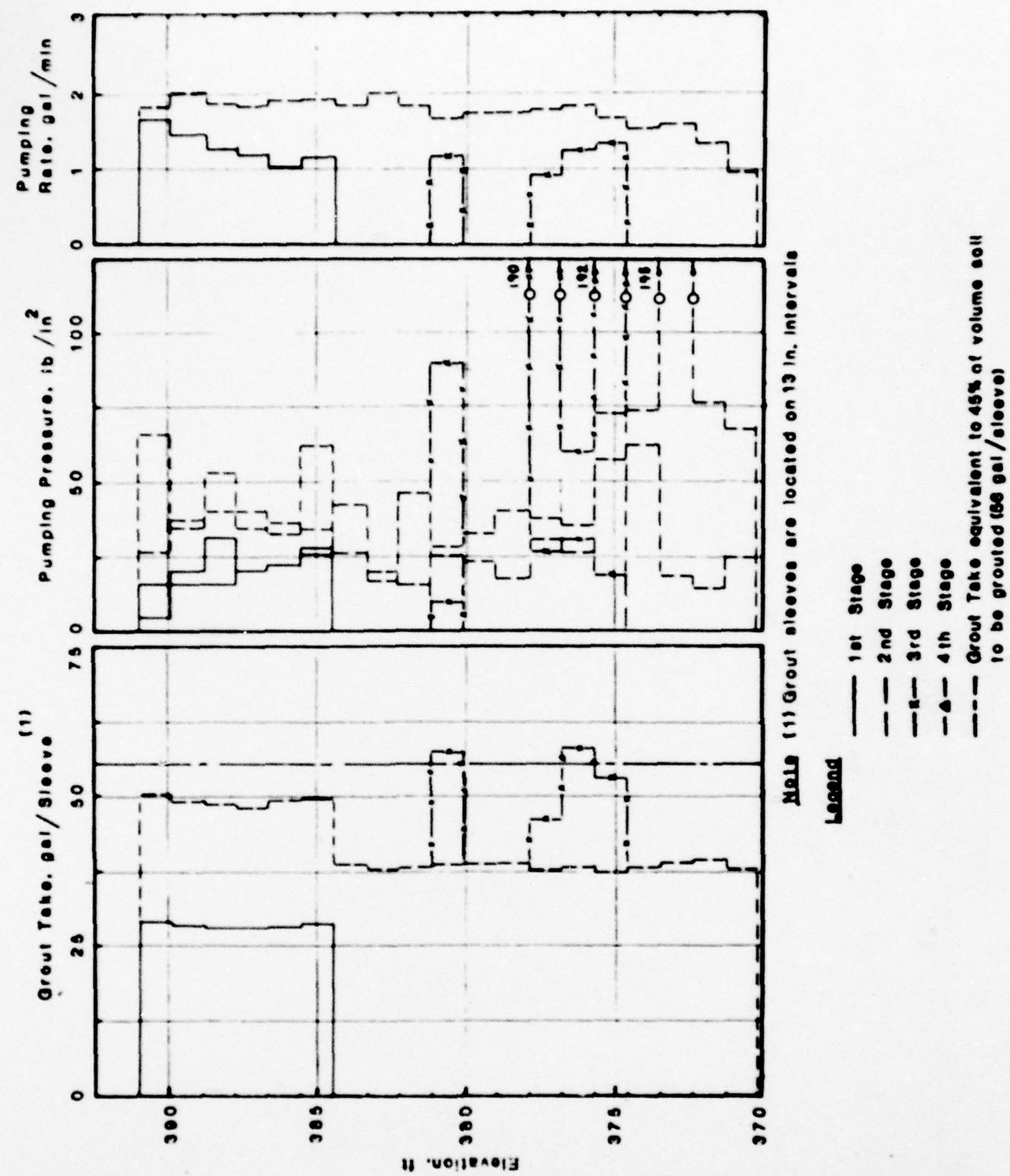
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. D-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.61

77C525, Phase II, Vol IIIA



PILE DRIVING EFFECTS TEST PROGRAM

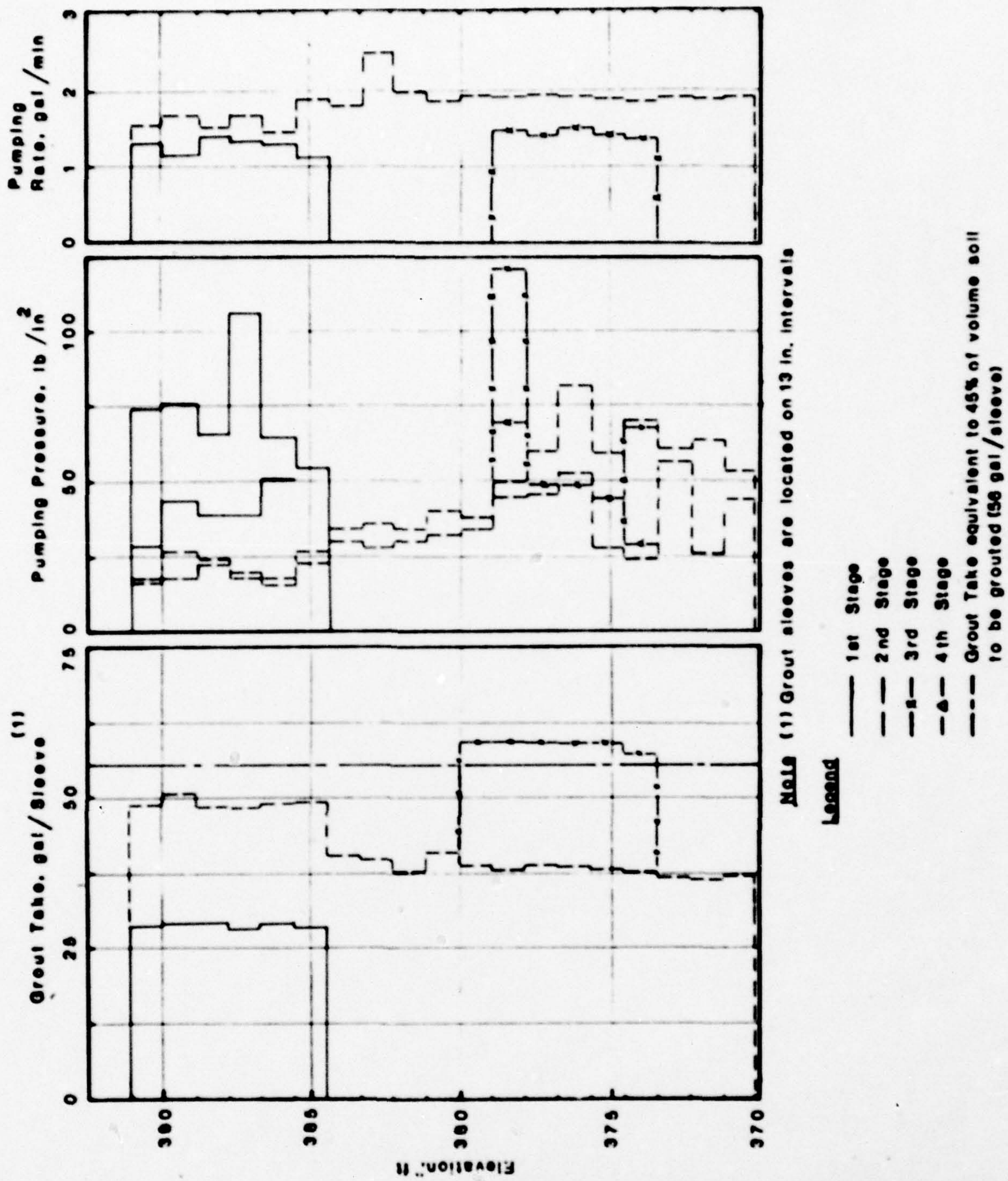
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. D-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.62

III A



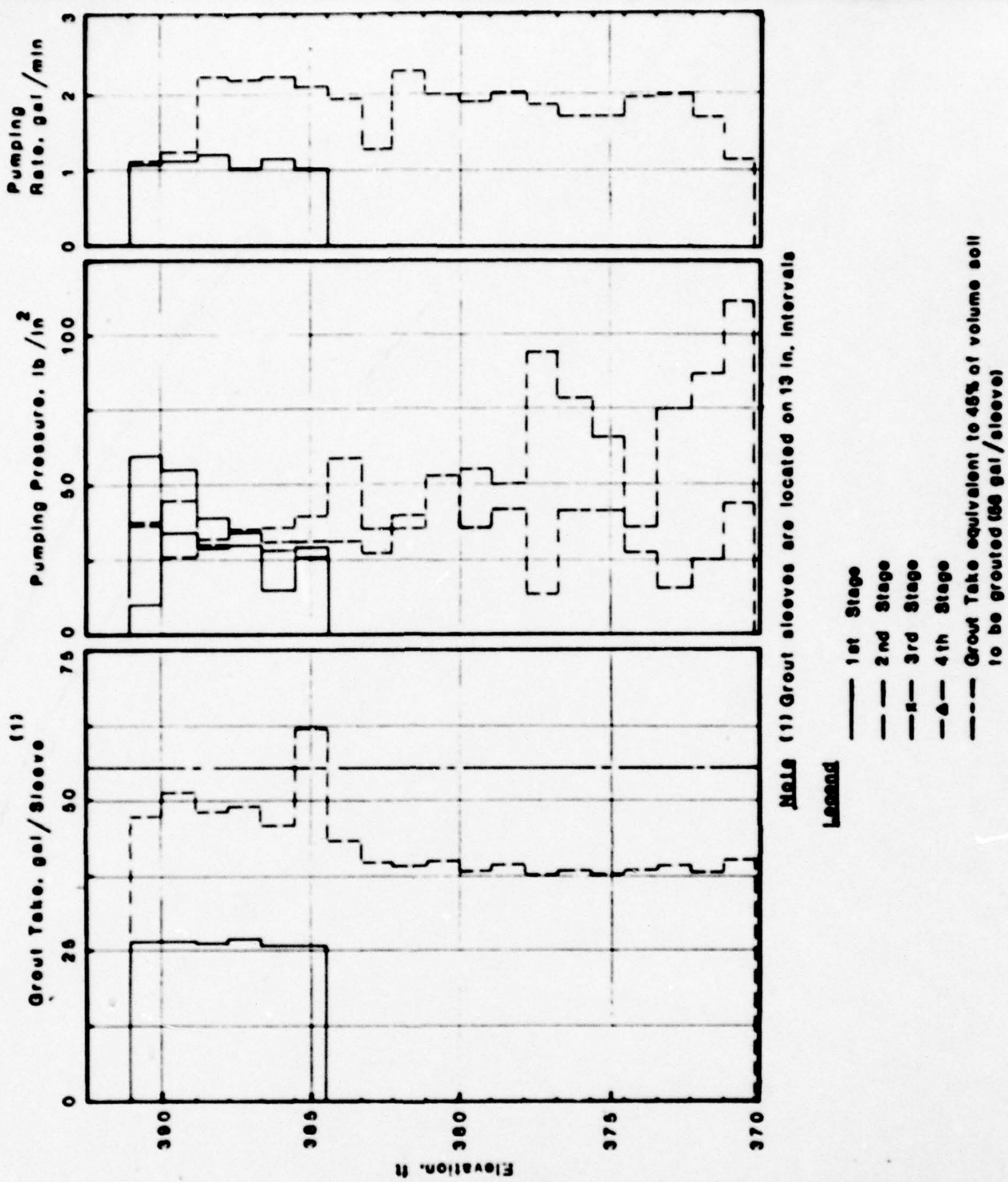
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. D-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.63



PILE DRIVING EFFECTS TEST PROGRAM

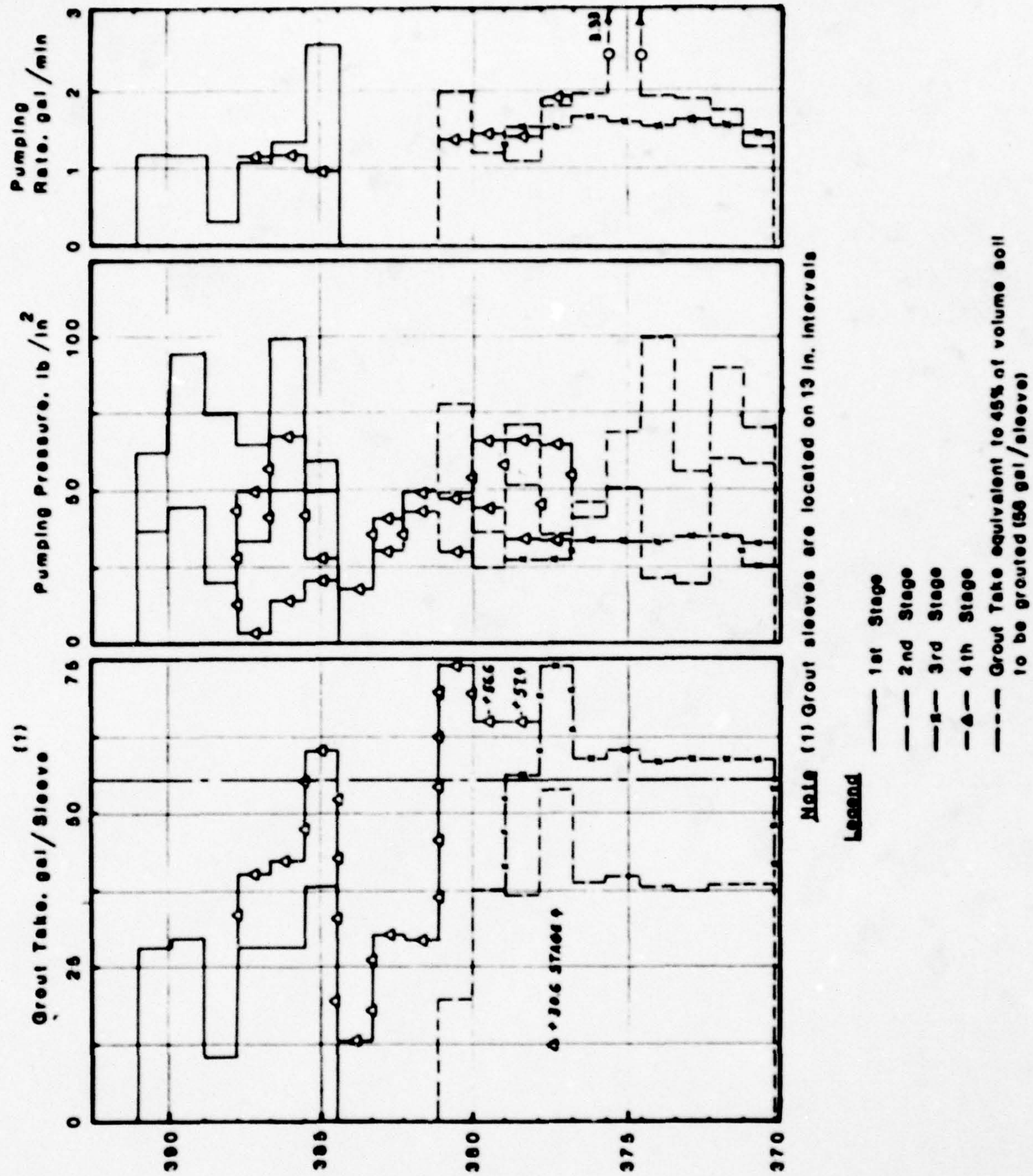
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. D-6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

77C029, Phase II; Vol IIA

Fig. K.64



PILE DRIVING EFFECTS TEST PROGRAM

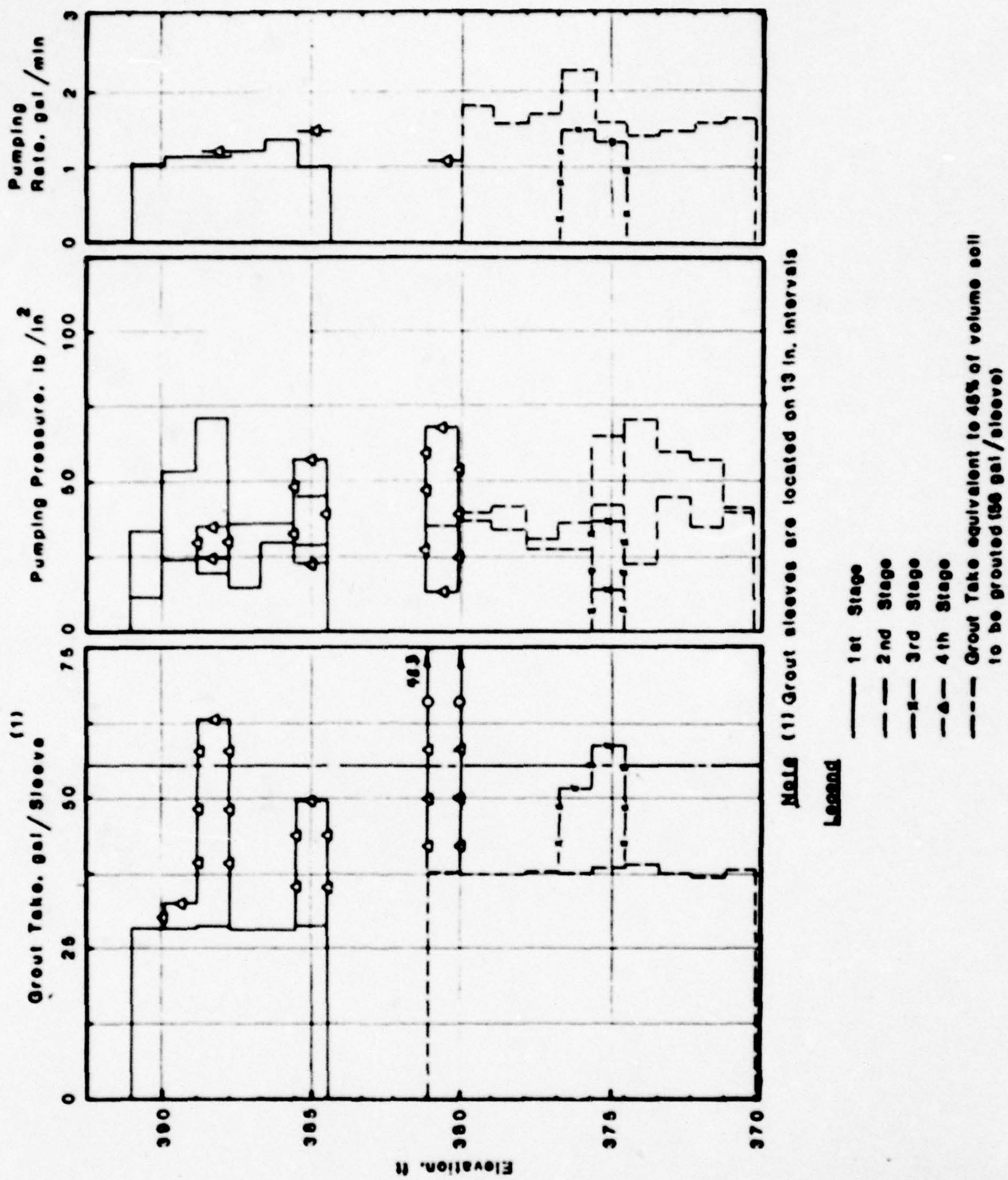
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. D-7

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0003

Woodward-Clyde Consultants

Fig. K.65

77C829, Phase II, Vol. II A



PILE DRIVING EFFECTS TEST PROGRAM

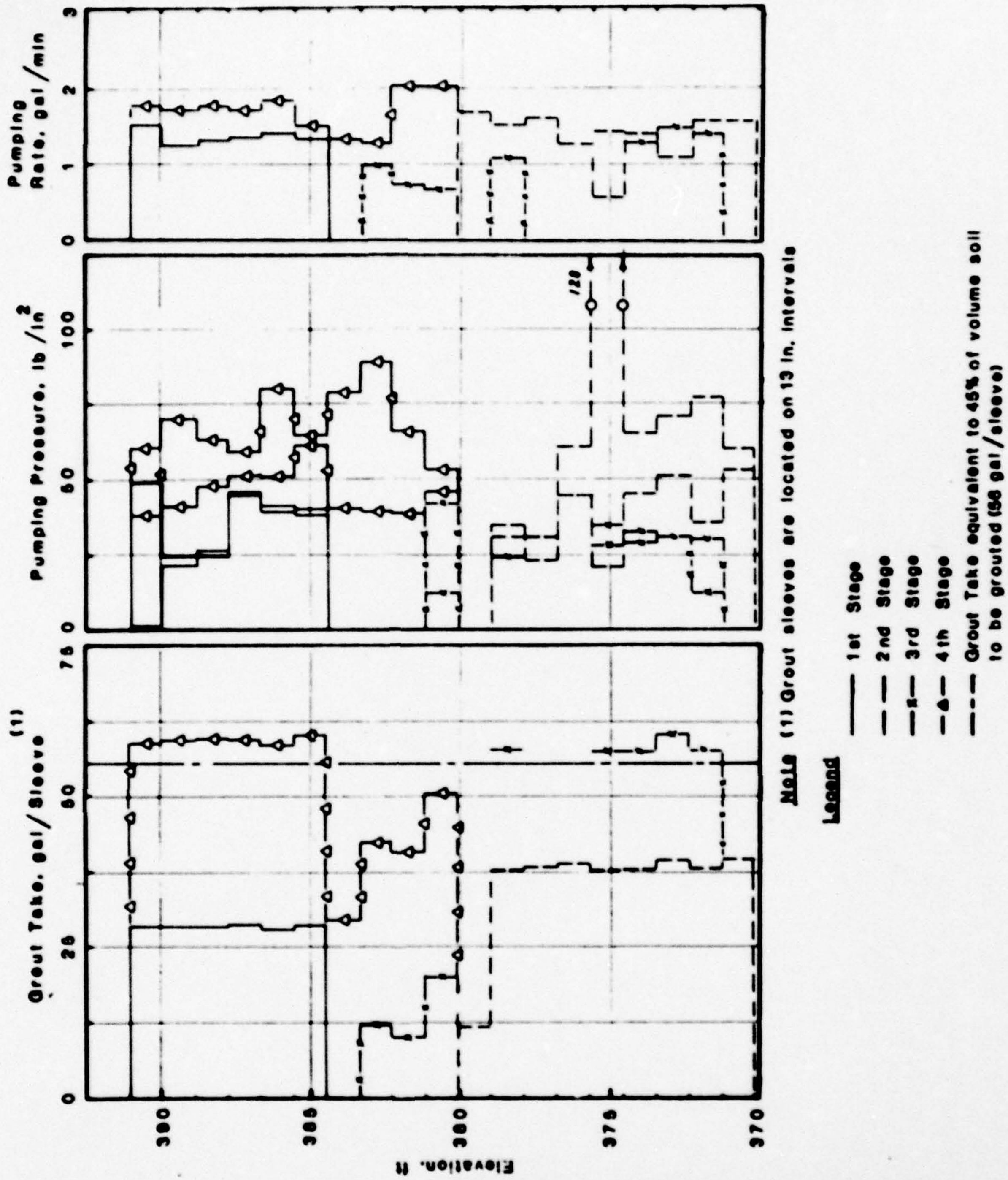
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. D-B-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

YTC020, Phase III, L1 IIA

Fig. K66



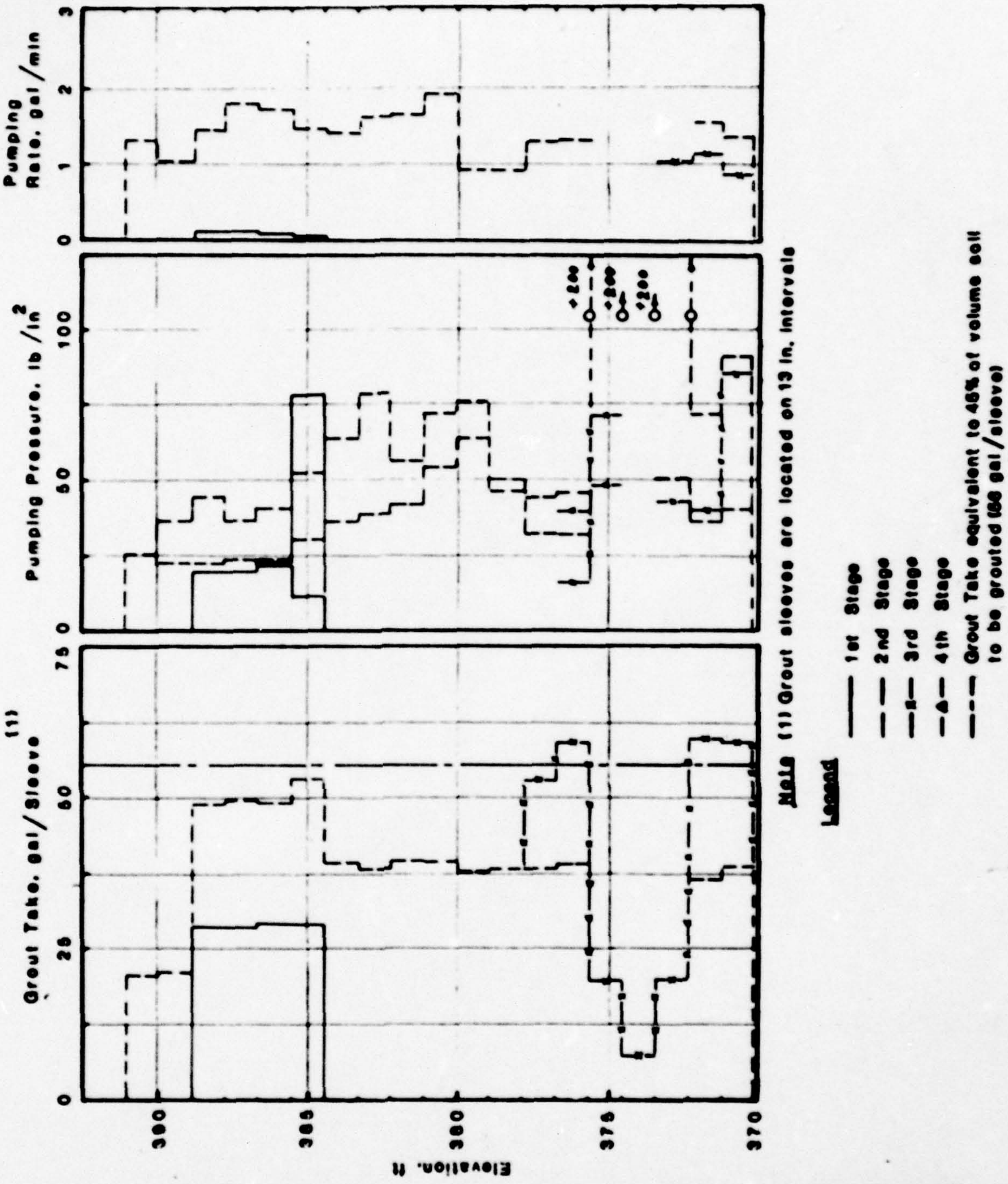
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. D.8-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0009

Woodward-Clyde Consultants

Fig. K.67



PILE DRIVING EFFECTS TEST PROGRAM

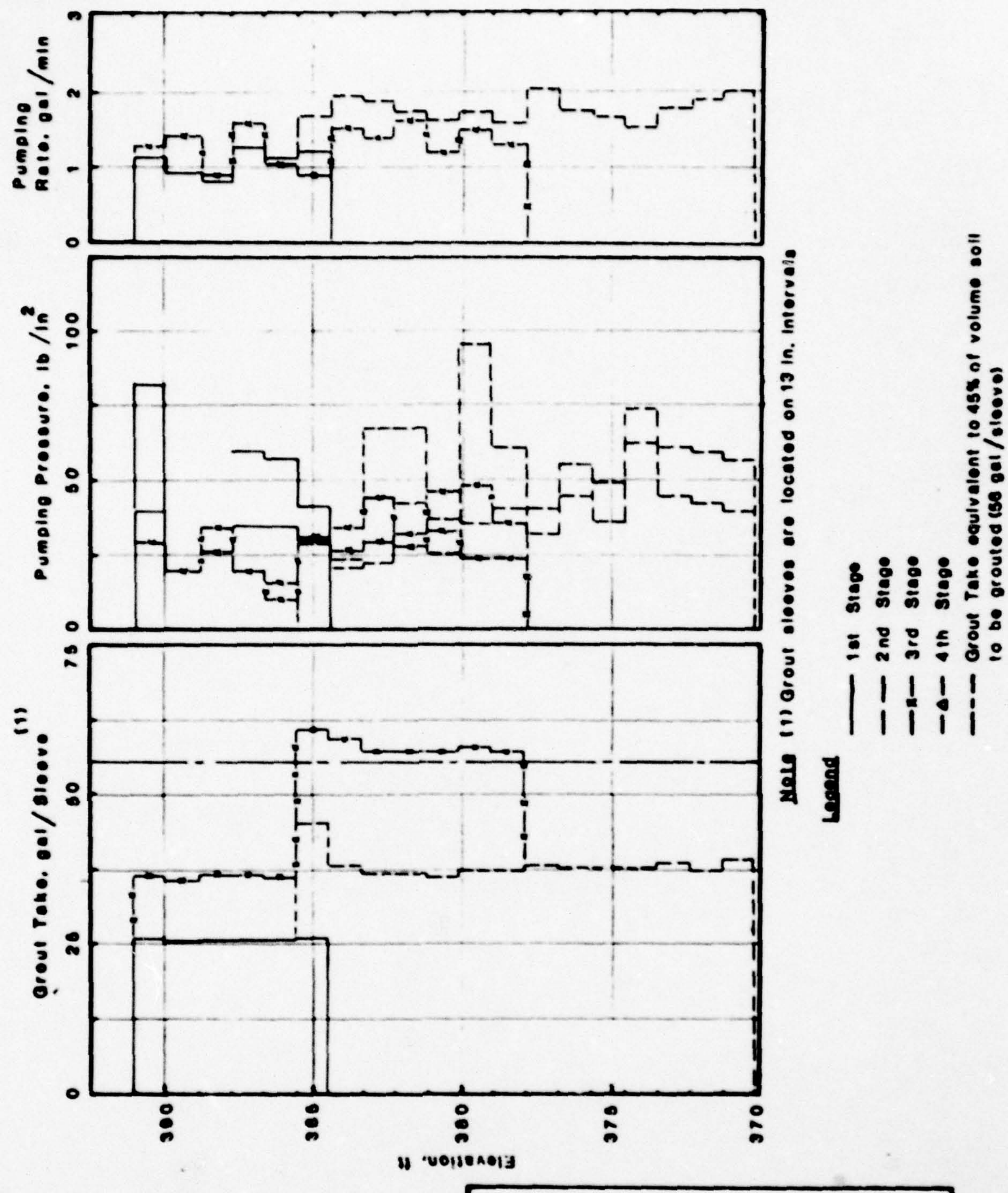
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. D-9

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0085

Woodward-Clyde Consultants

77C979, Phase II; Vol III A

Fig. K.68



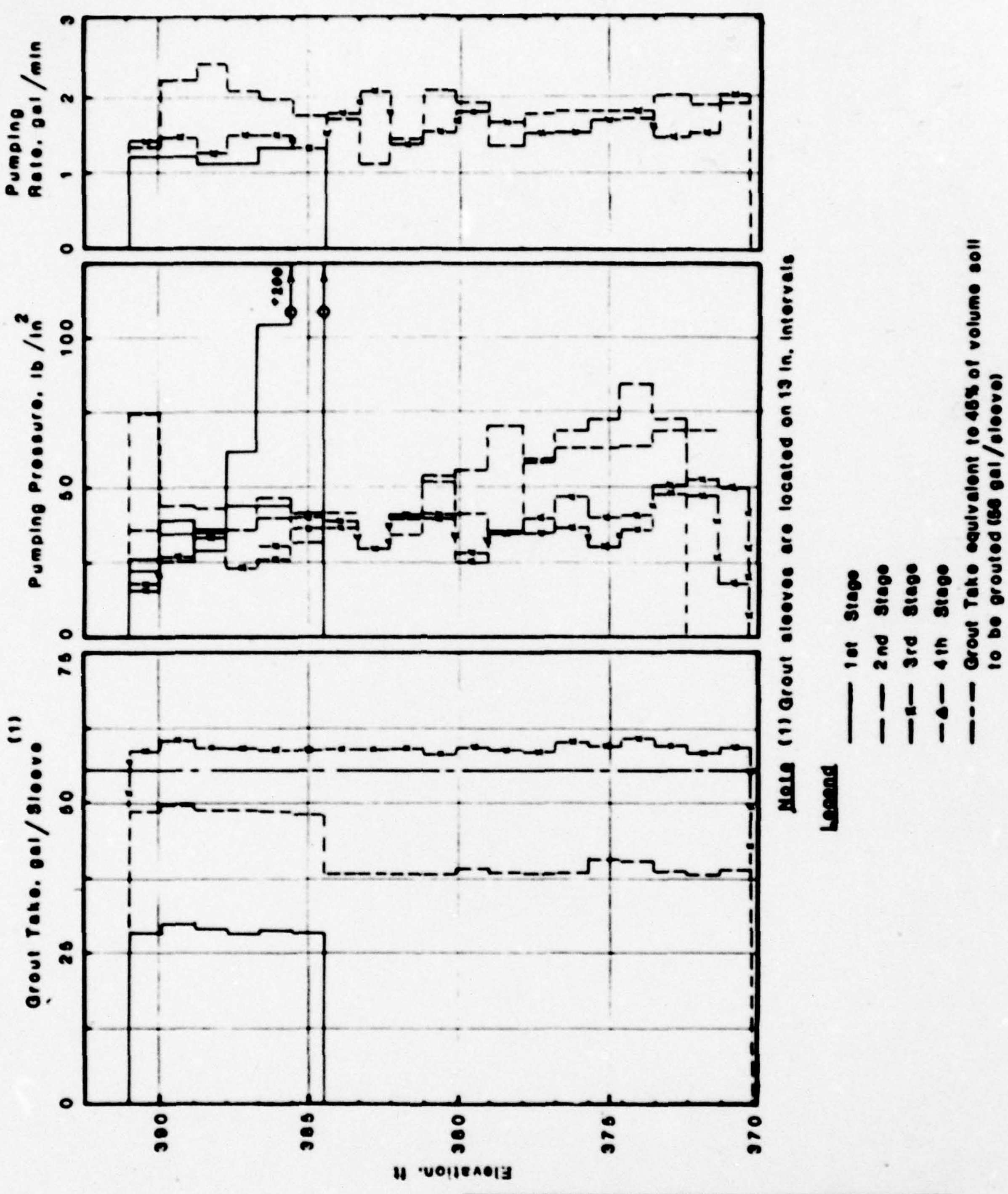
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. D-10

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.69



PILE DRIVING EFFECTS TEST PROGRAM

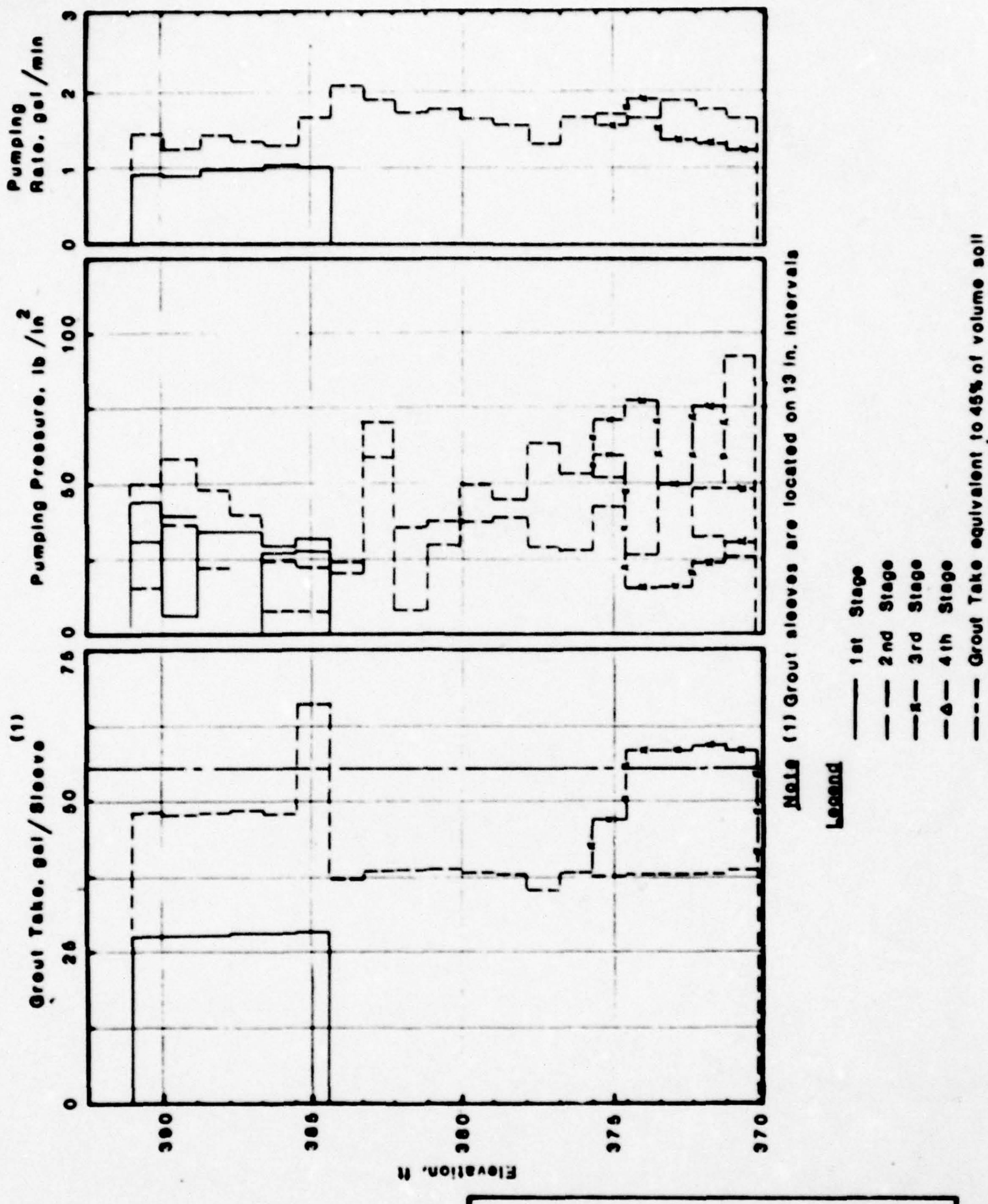
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. E-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig.K.70

ST C825, Phase II, Vol III A



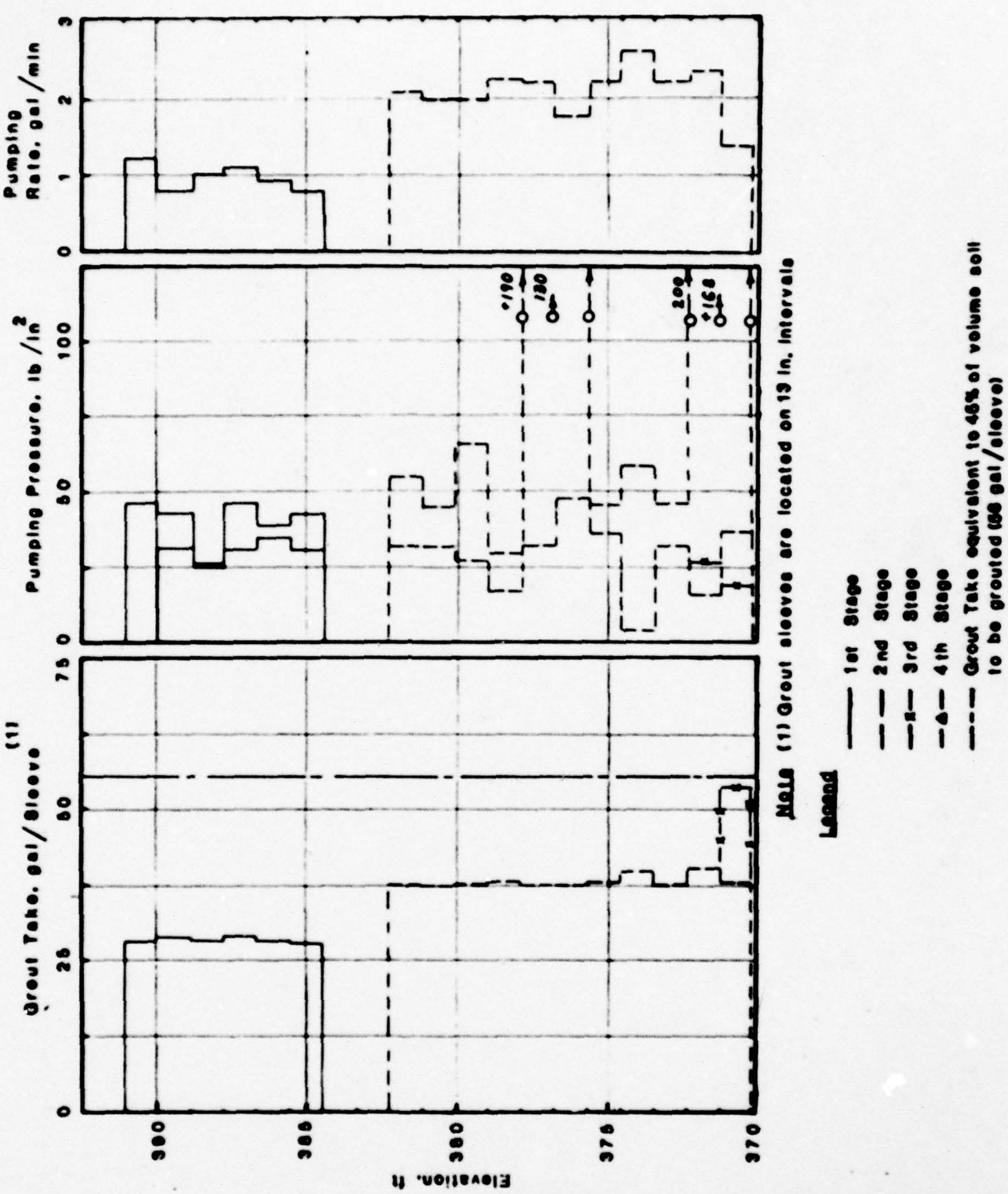
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. E-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0009

Woodward-Clyde Consultants

Fig. K. 71



PILE DRIVING EFFECTS TEST PROGRAM

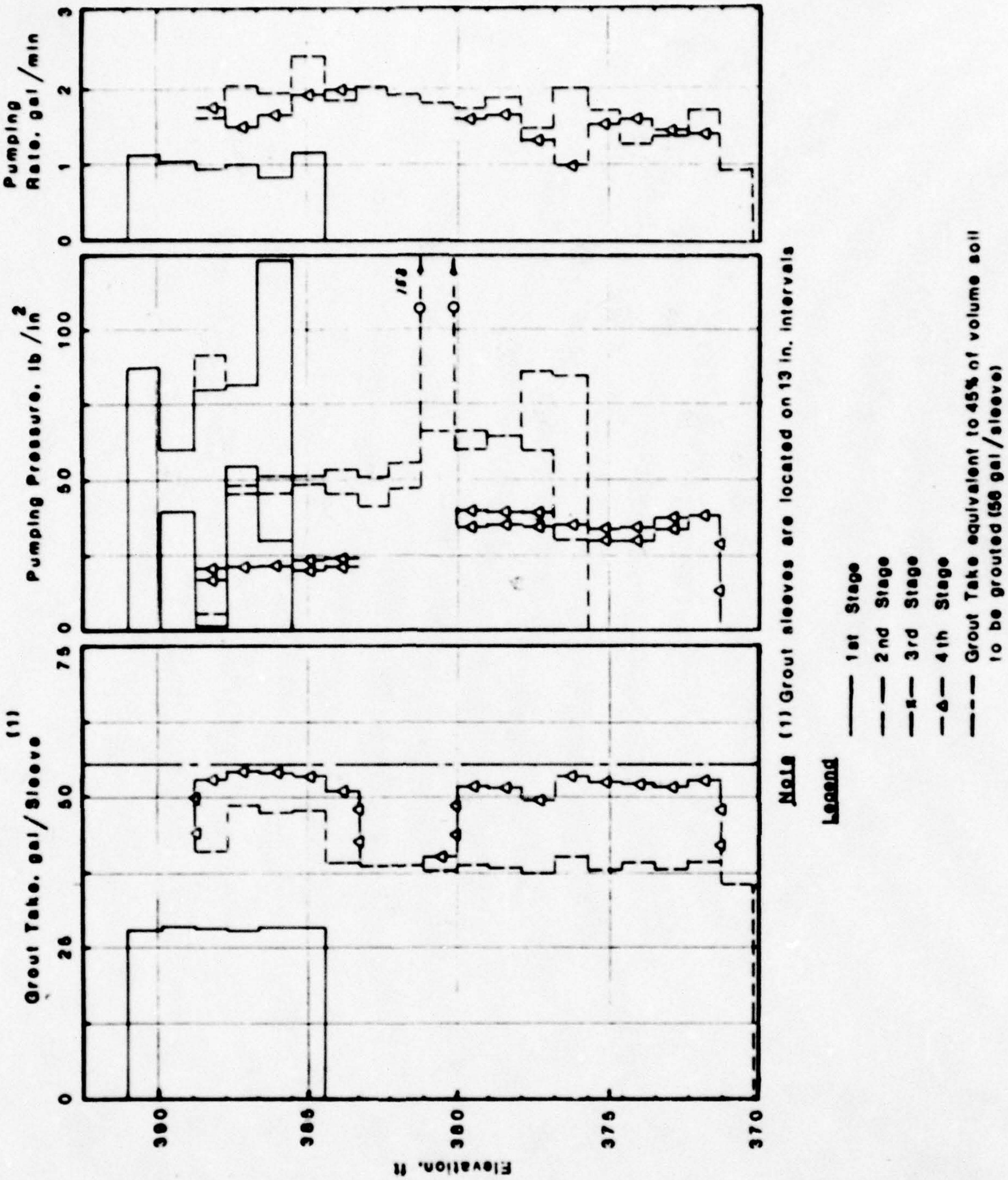
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. E-3*

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

77C025, Phase III, Vol IIIA

Fig. K.72



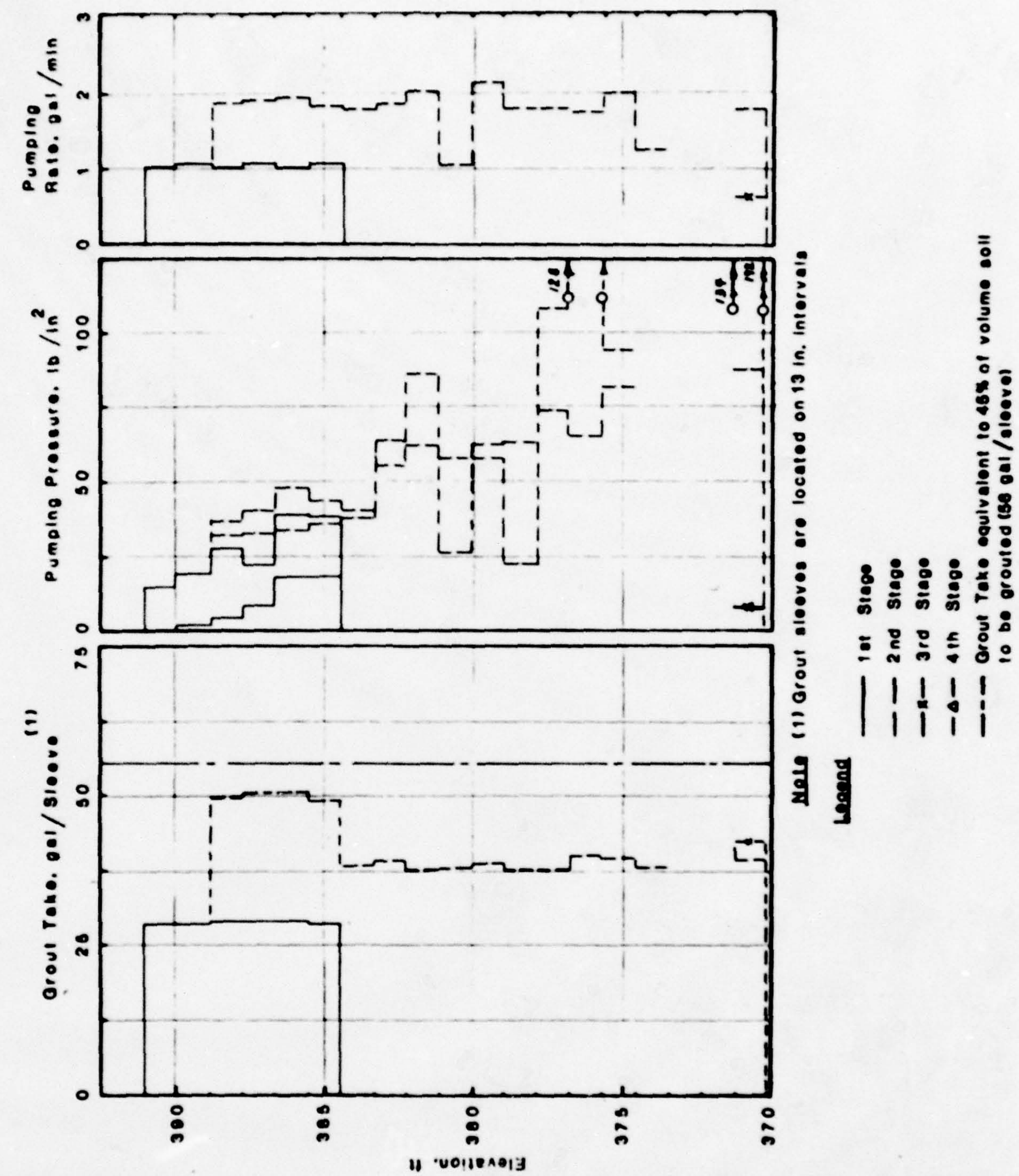
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. E.3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0039

Woodward-Clyde Consultants

Fig. K.73



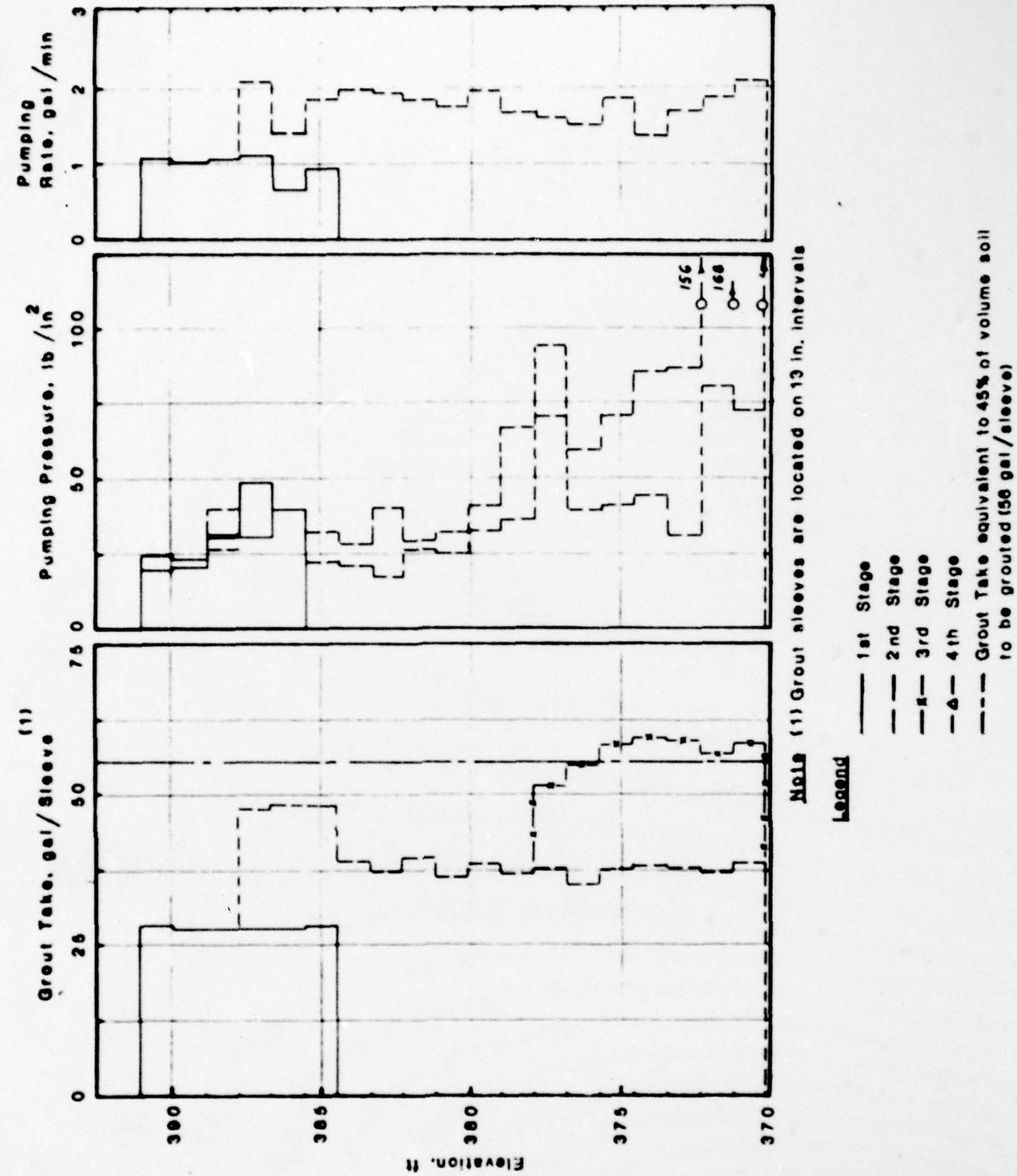
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. E.4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K. 74



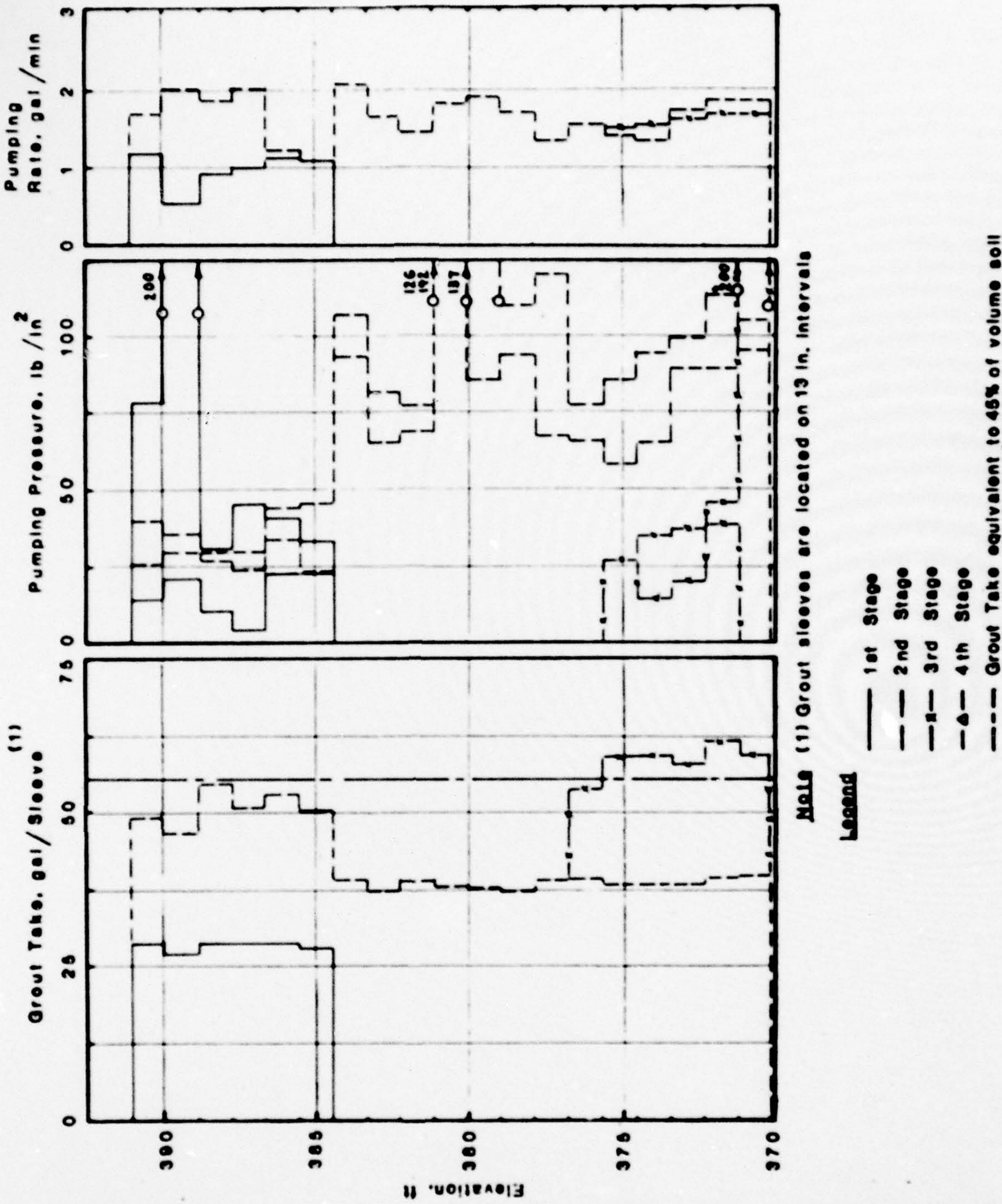
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. E-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants
77C829, Phase II, VI II A

Fig. K.15



PILE DRIVING EFFECTS TEST PROGRAM

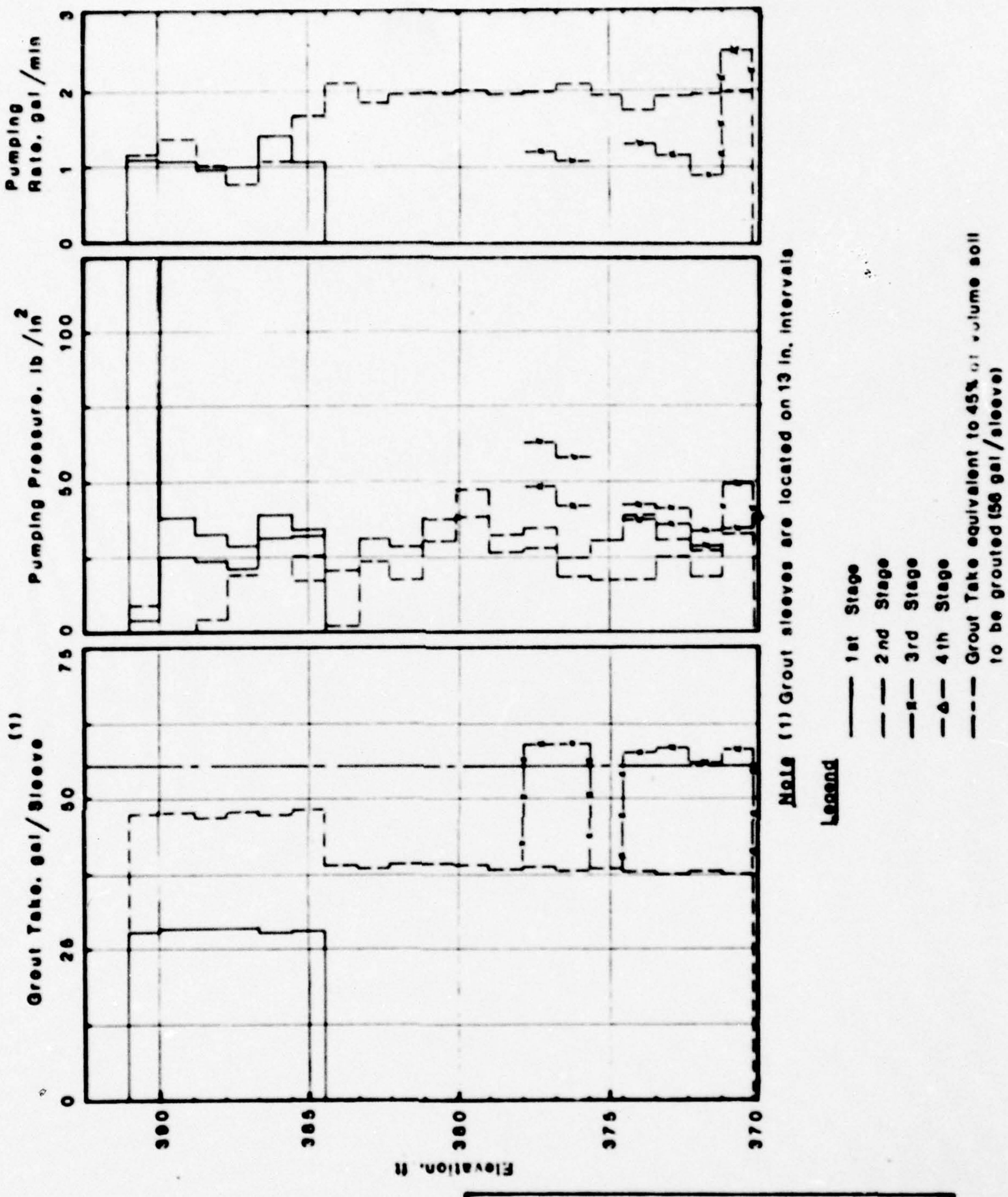
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. E-6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0065

Woodward-Clyde Consultants

YTC825, Phase II, Vol IIIA

Fig. K.76



PILE DRIVING EFFECTS TEST PROGRAM

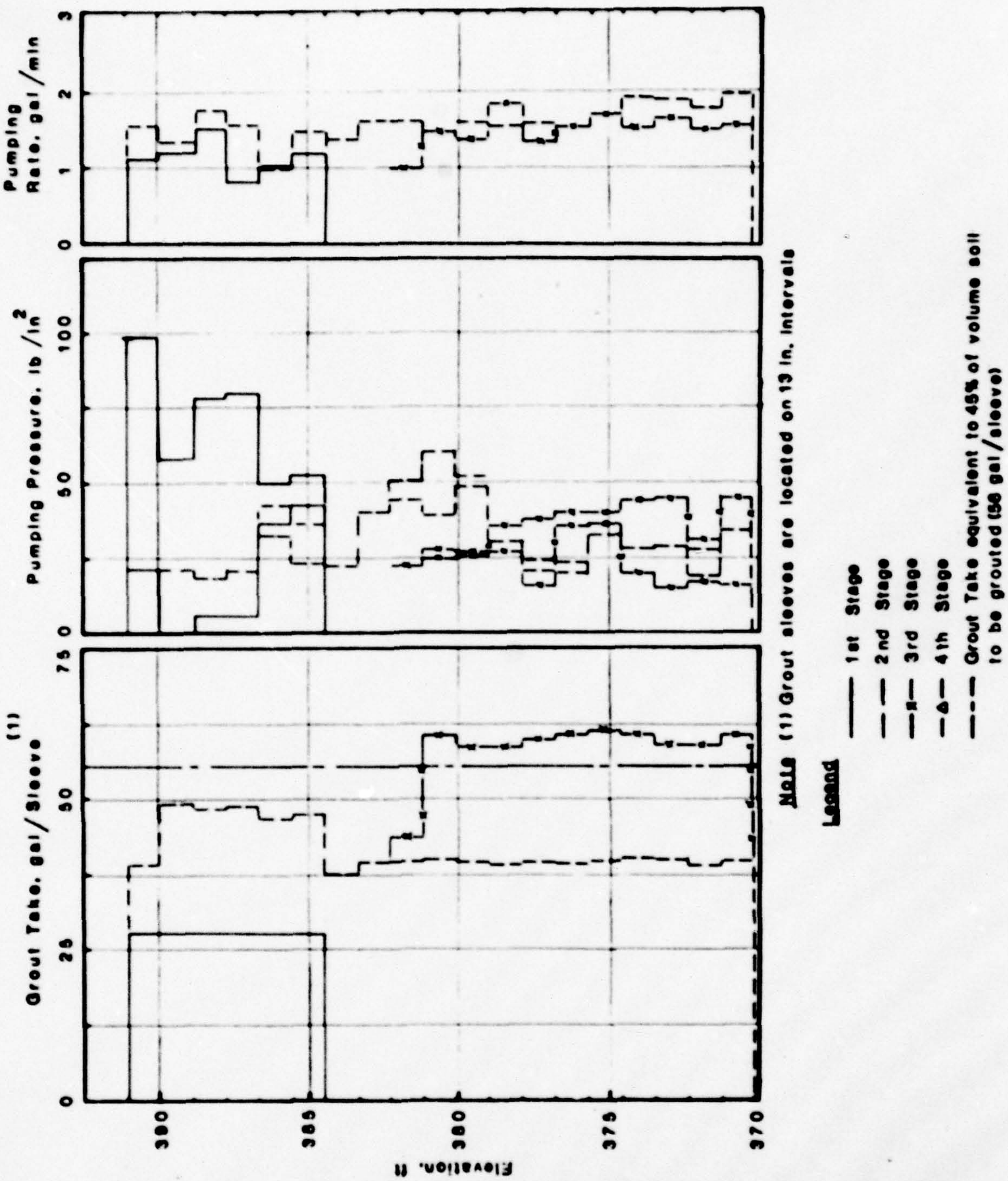
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. E-8

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.17

77C825, Phase IV, Vol II A



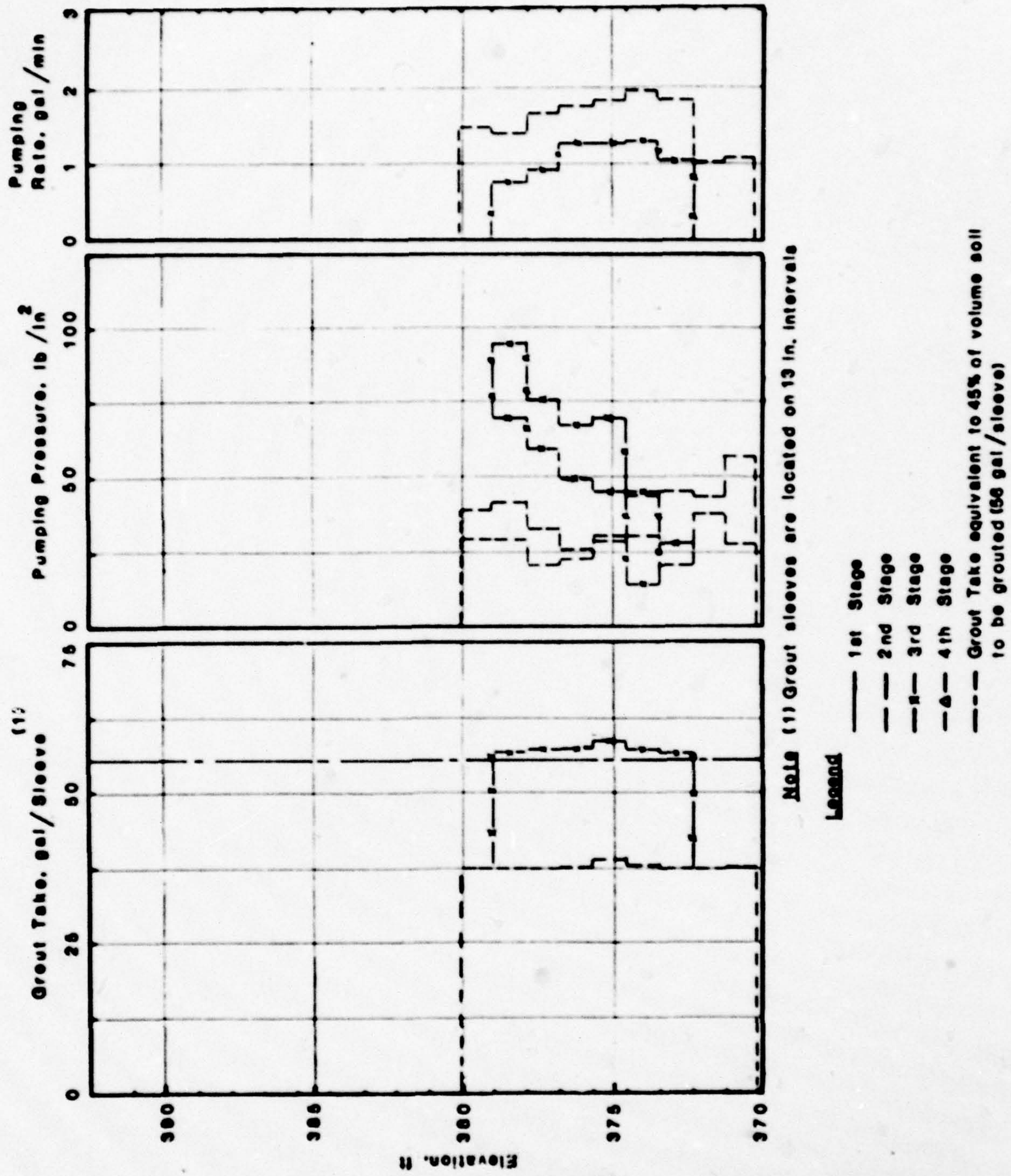
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. E.9

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.78



PILE DRIVING EFFECTS TEST PROGRAM

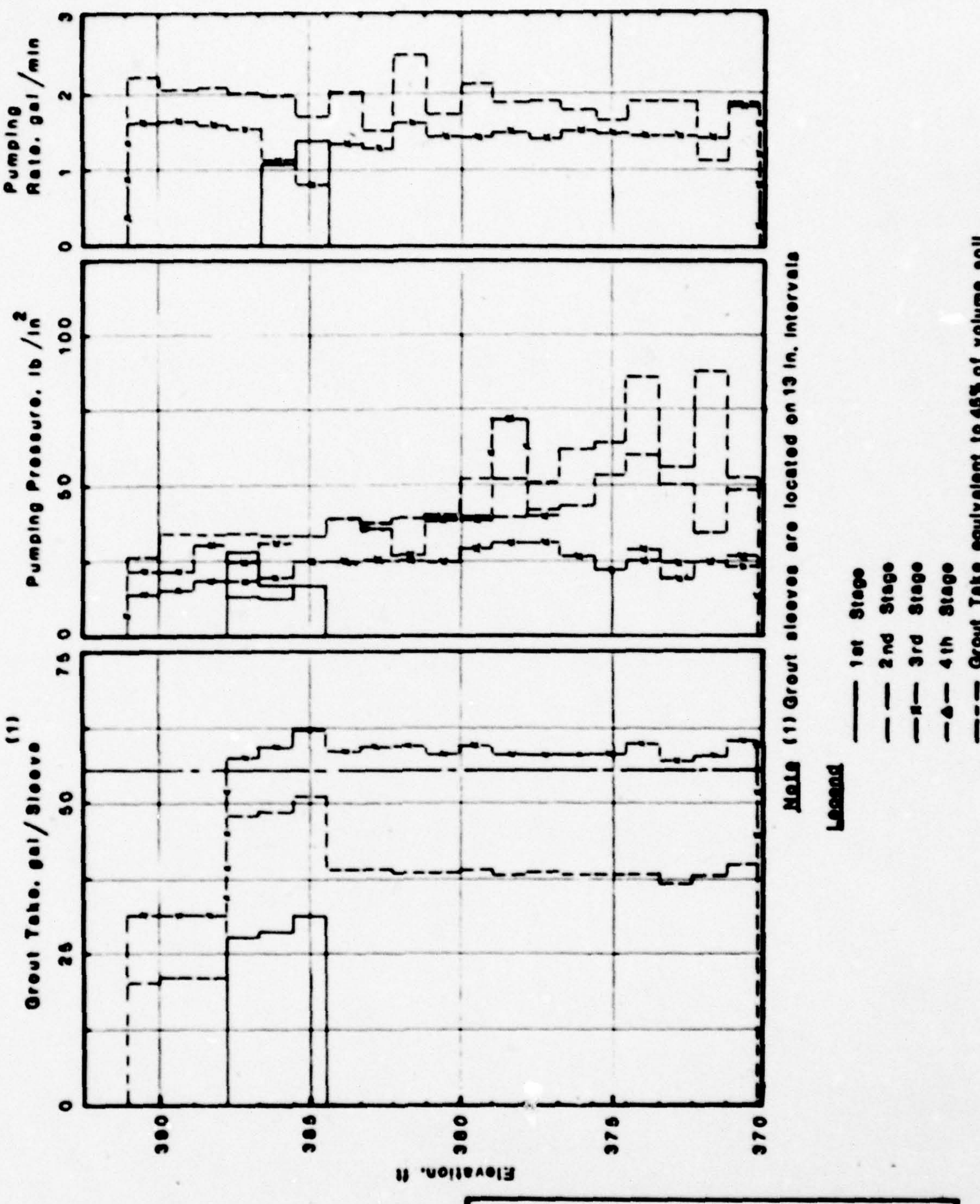
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. E-10

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

77C929, Phase III, VI IIIA

Fig. K.79



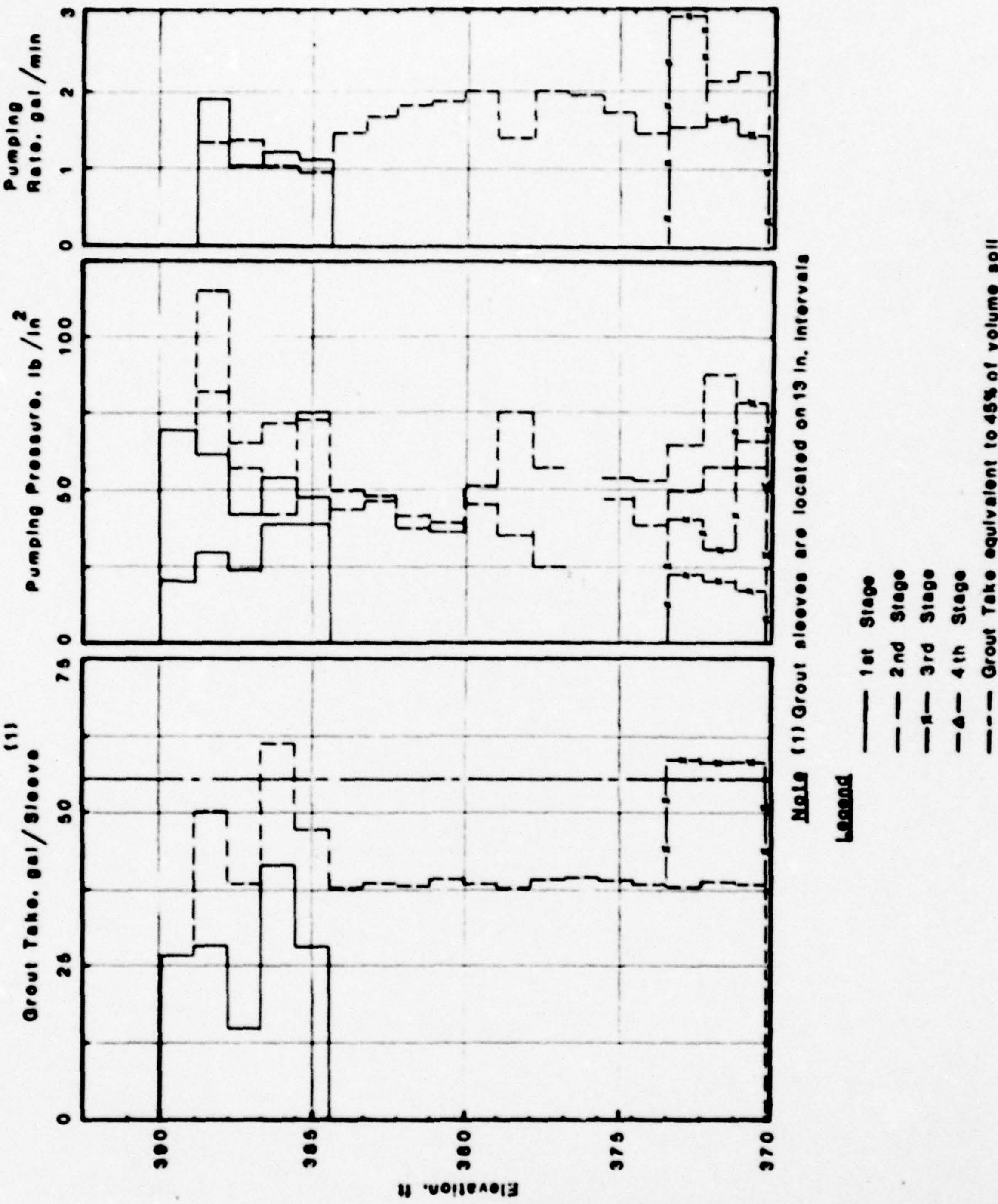
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. F-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0088

Woodward-Clyde Consultants

Fig. K.80



PILE DRIVING EFFECTS TEST PROGRAM

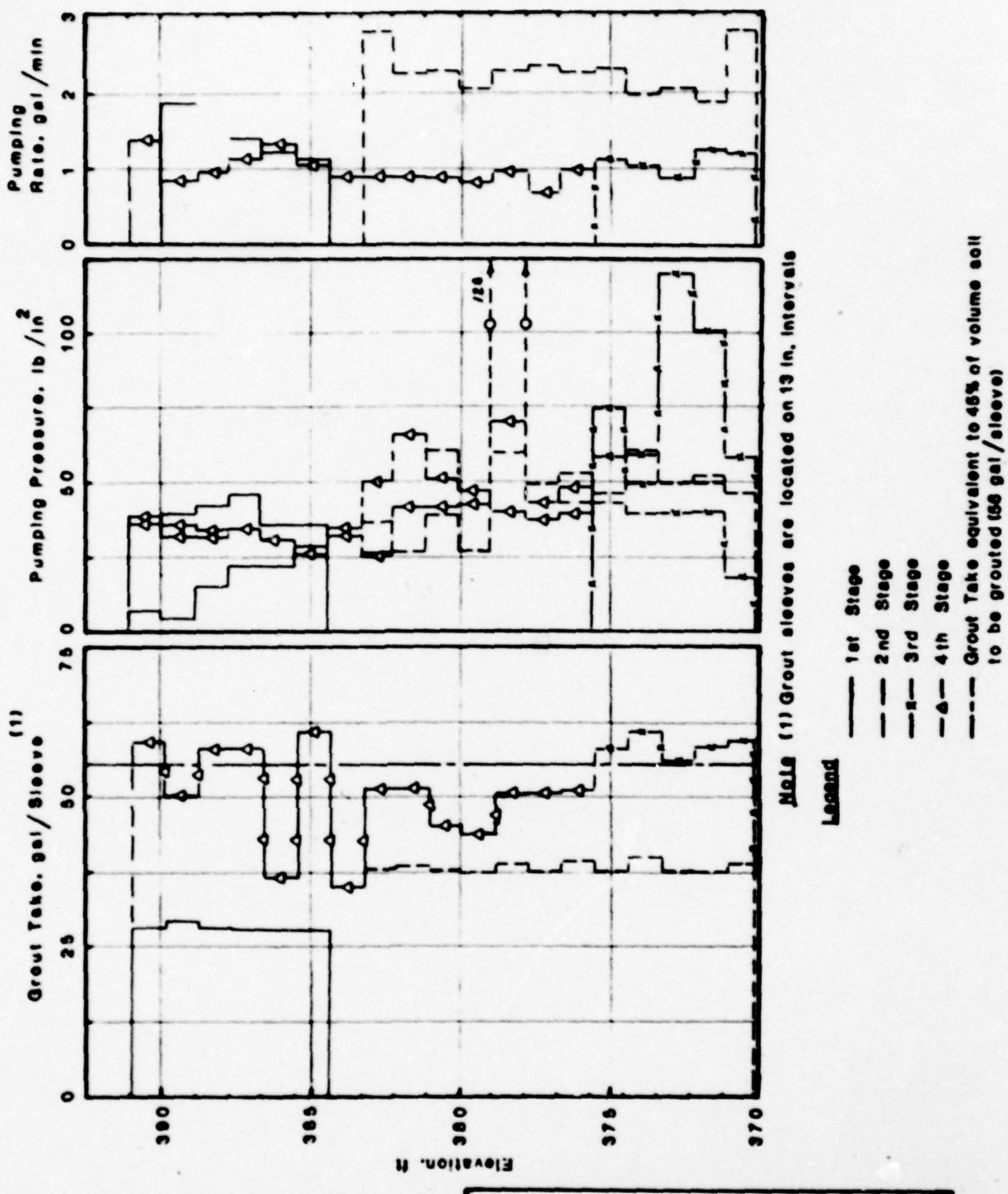
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. F-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.8/

77C825, Phase II-A



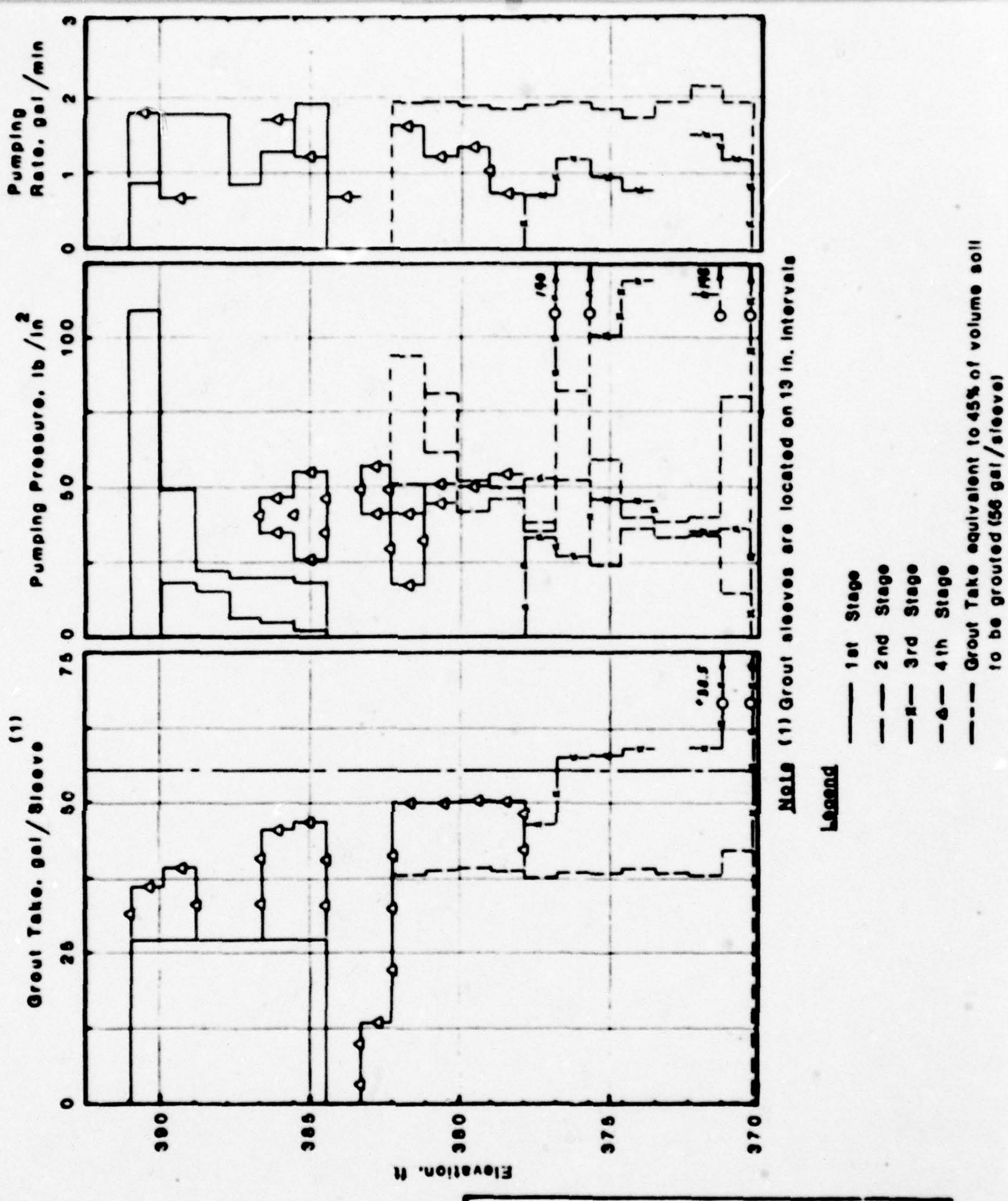
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. F-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0000

Woodward-Clyde Consultants
77C829, Phase III, K1 IIIA

Fig. K. 82



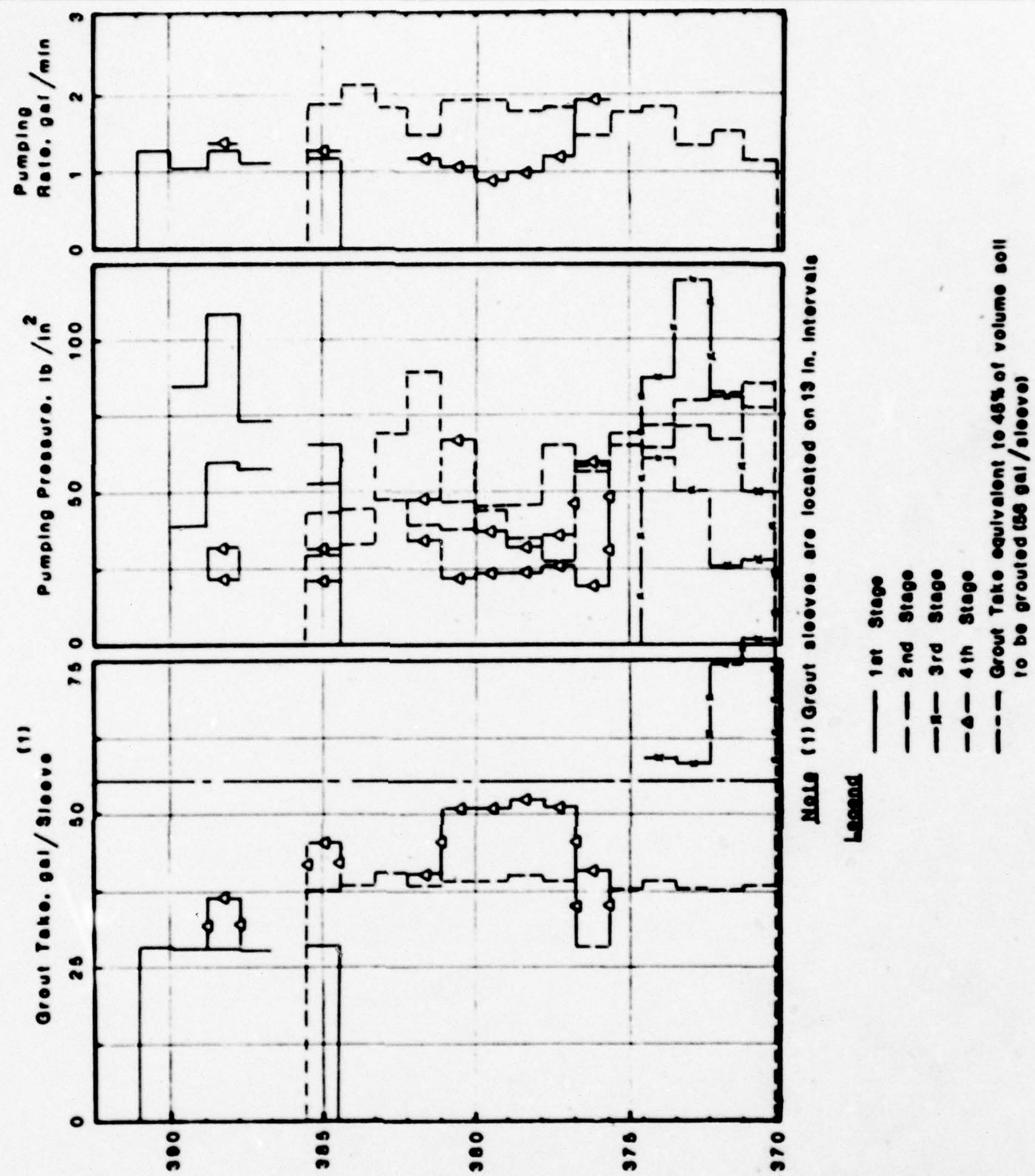
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. F-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-76-C-0039

Woodward-Clyde Consultants

Fig. K.83



PILE DRIVING EFFECTS TEST PROGRAM

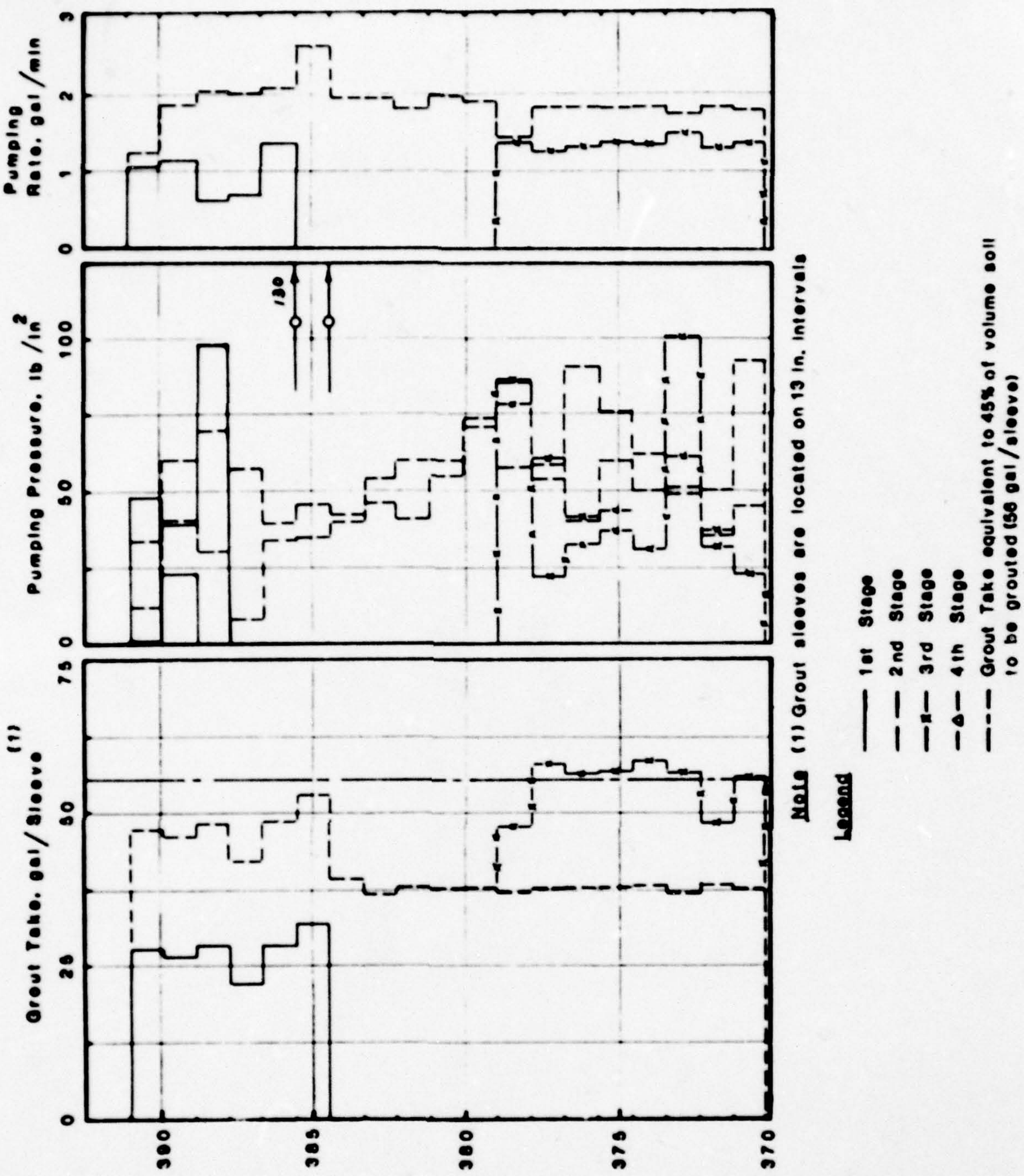
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. FF

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K. 84

Phase II; Vol III A



PILE DRIVING EFFECTS TEST PROGRAM

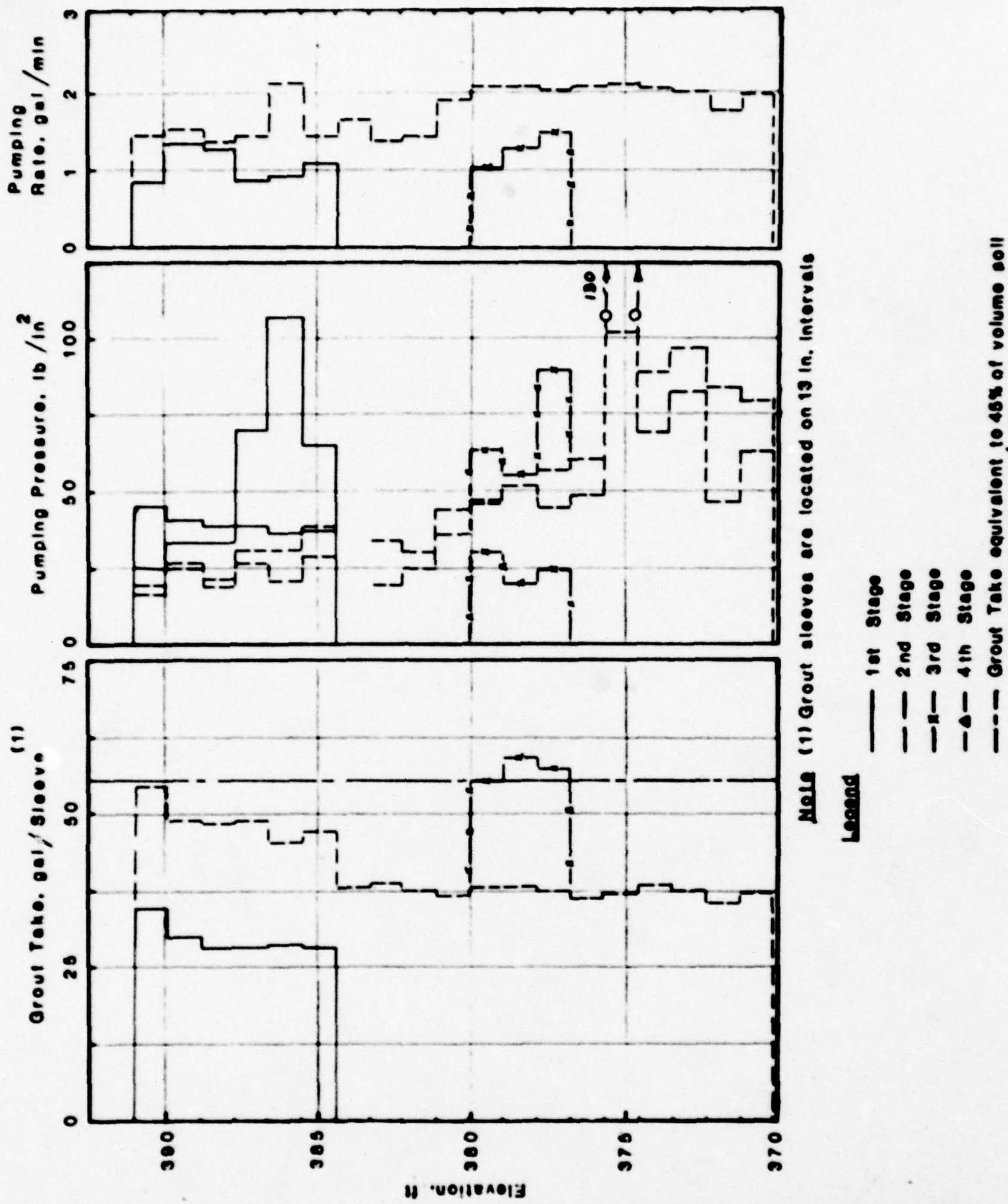
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. F-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

77C029, Phase III, Vol III A

Fig. K.85



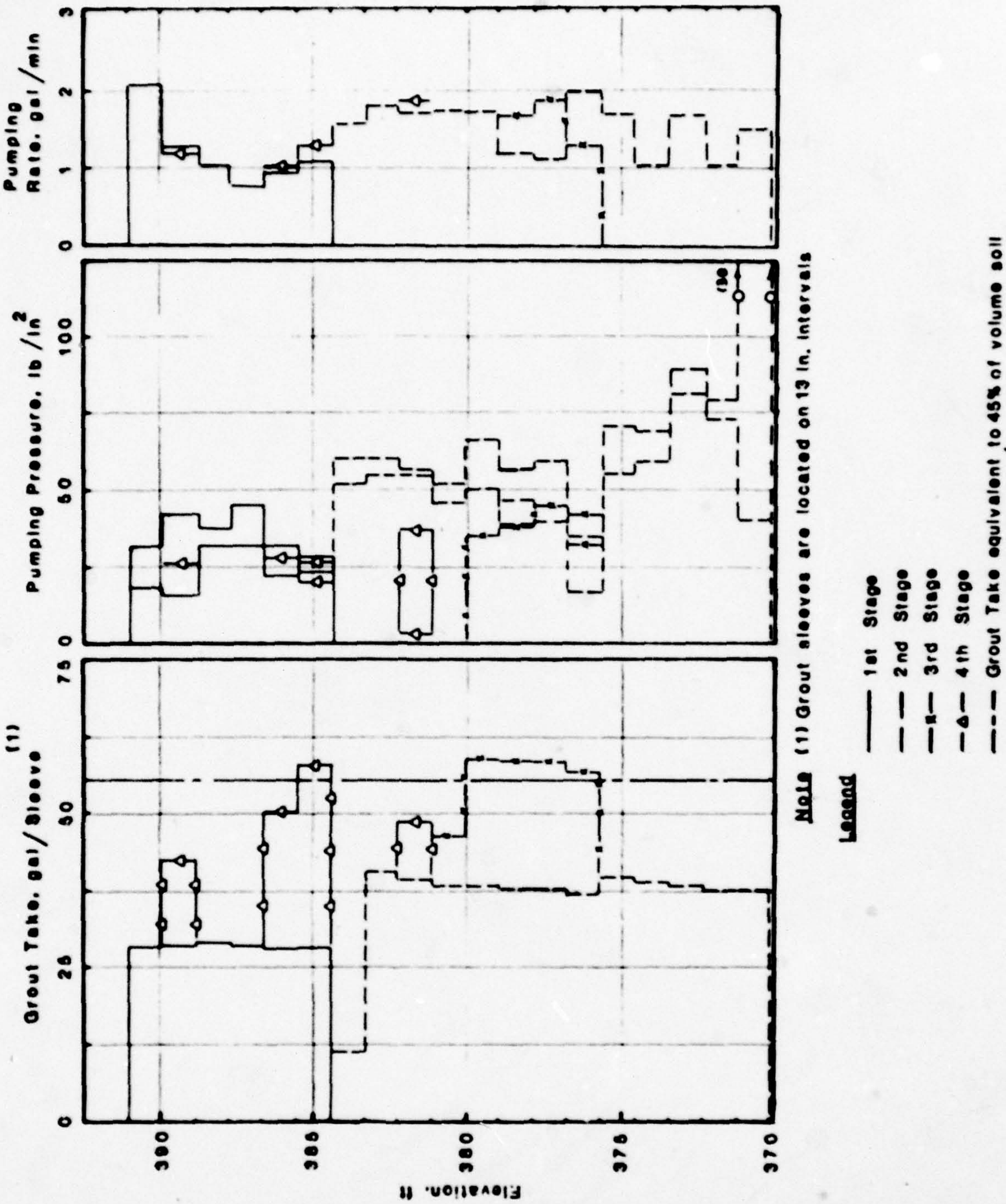
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. F-6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.86



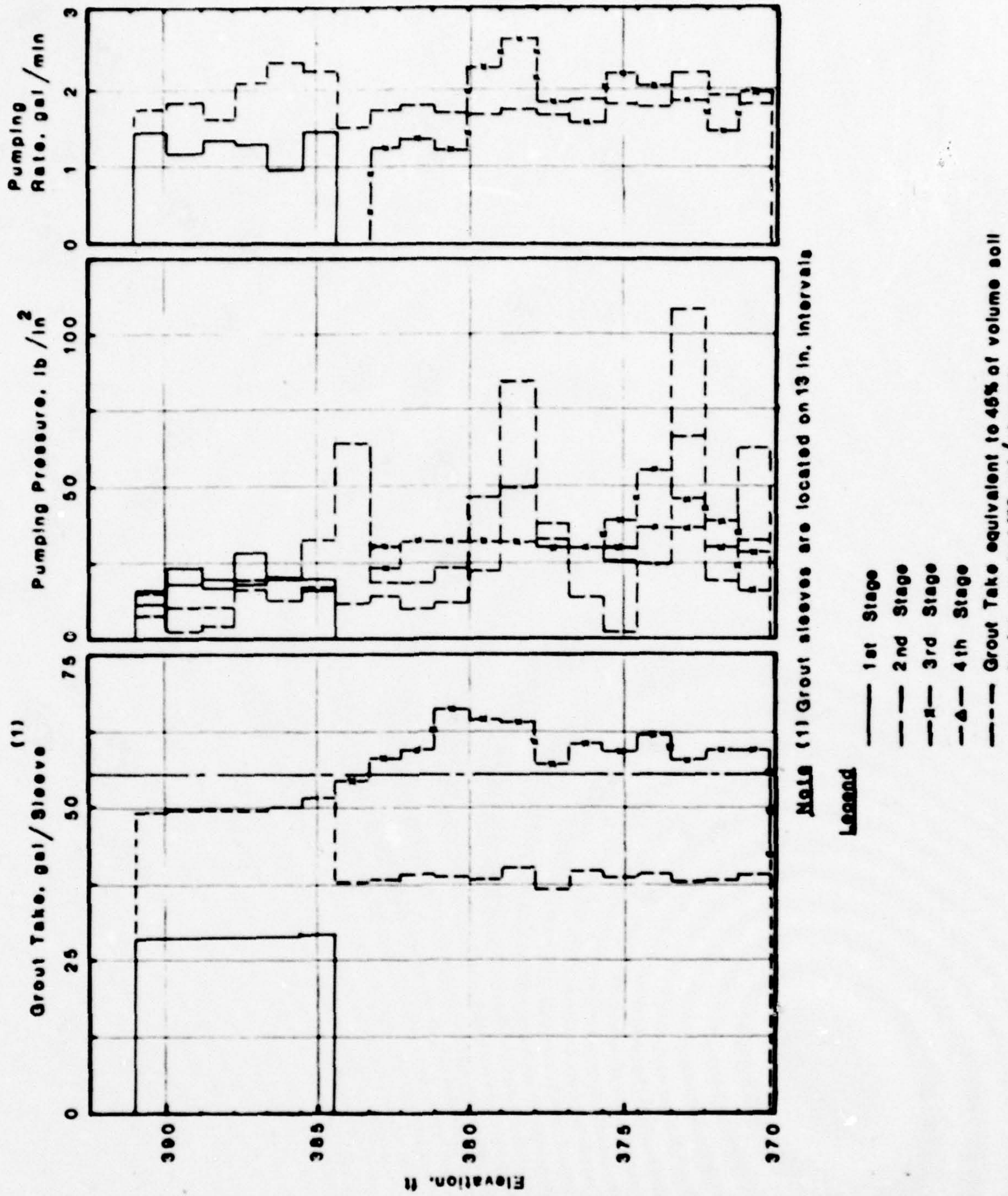
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. F-7

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0009

Woodward-Clyde Consultants

Fig. K.87



PILE DRIVING EFFECTS TEST PROGRAM

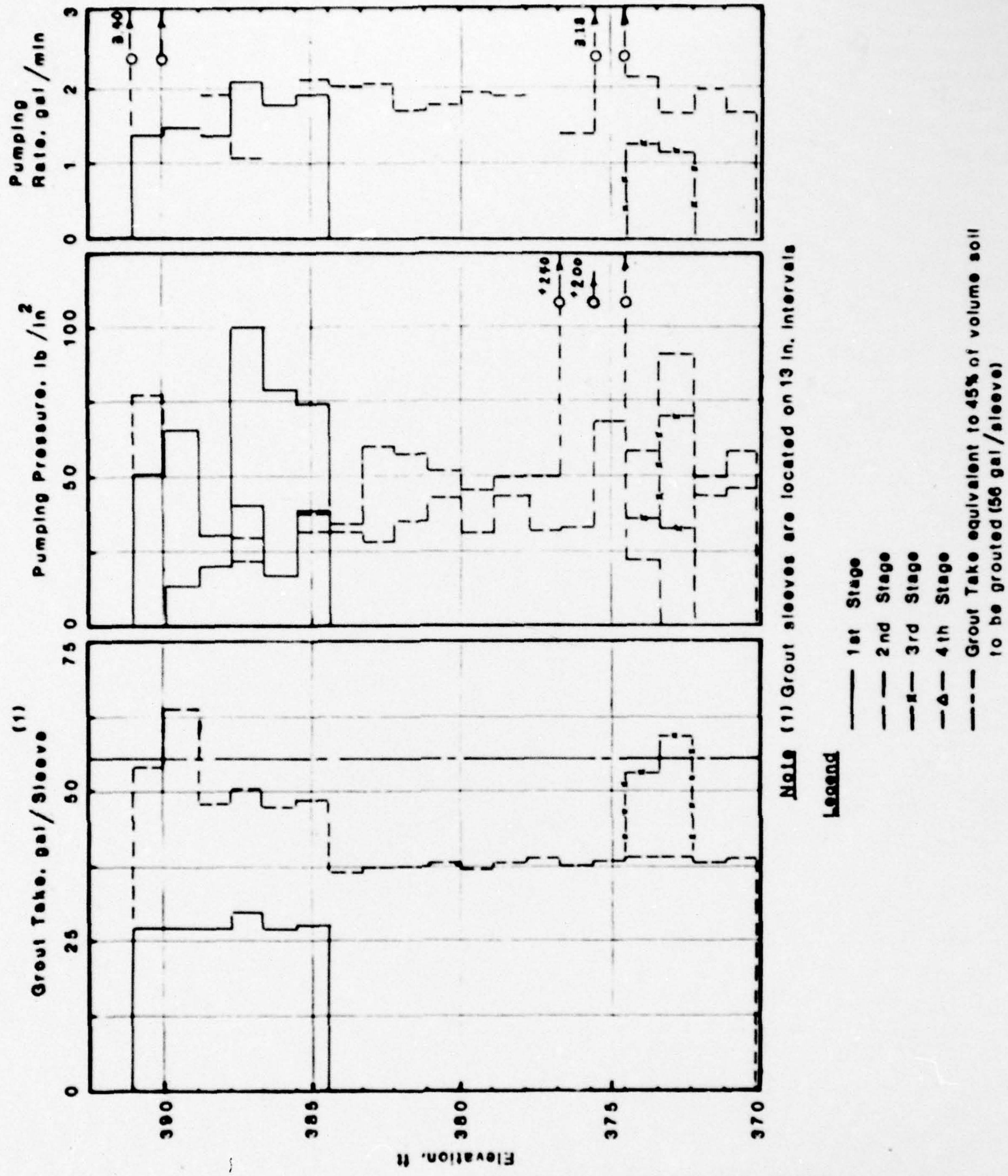
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. F-8

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0008

Woodward-Clyde Consultants

77C425, Phase II, IV, III A

Fig.K.88



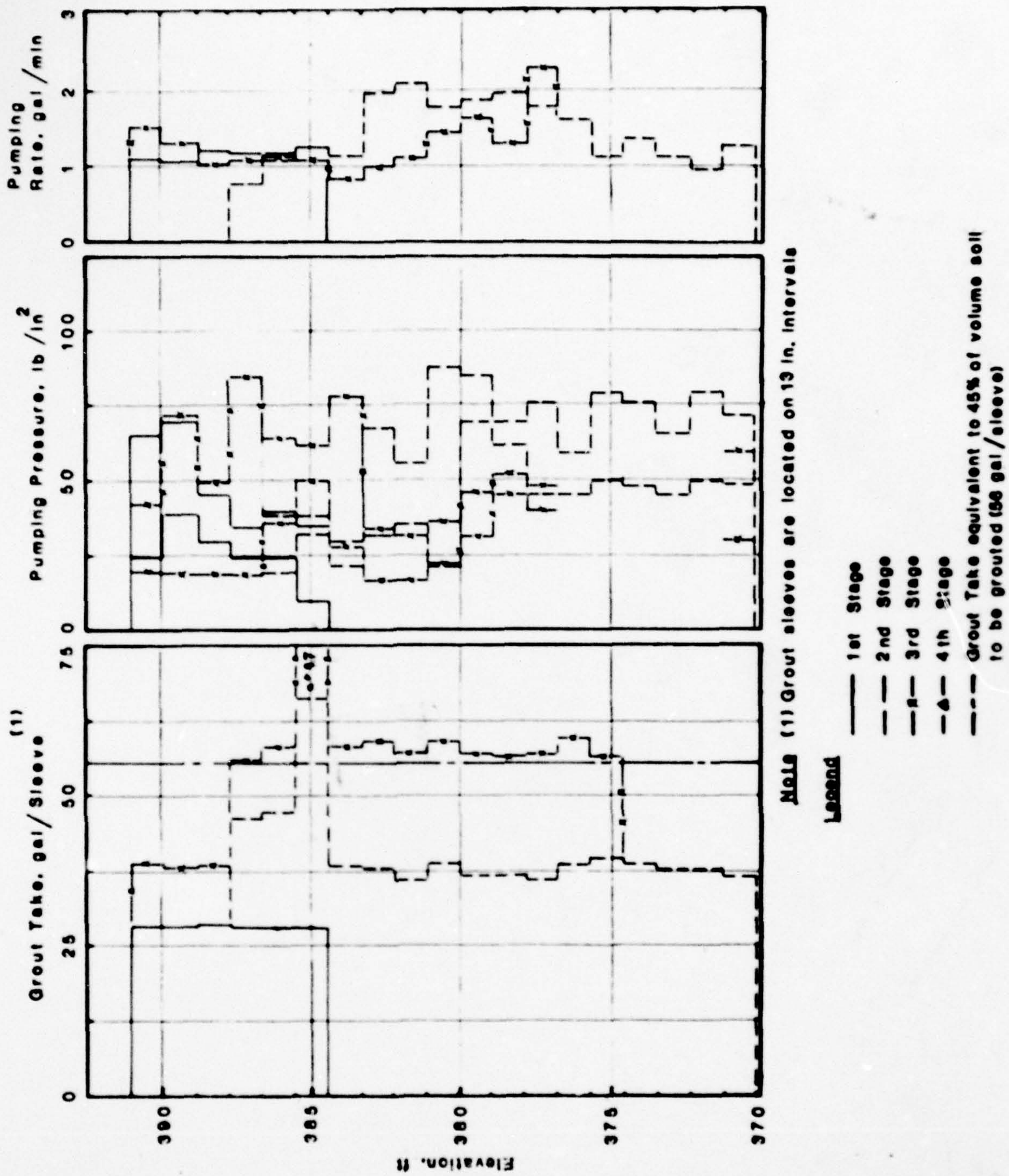
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. F-9

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.89



PILE DRIVING EFFECTS TEST PROGRAM

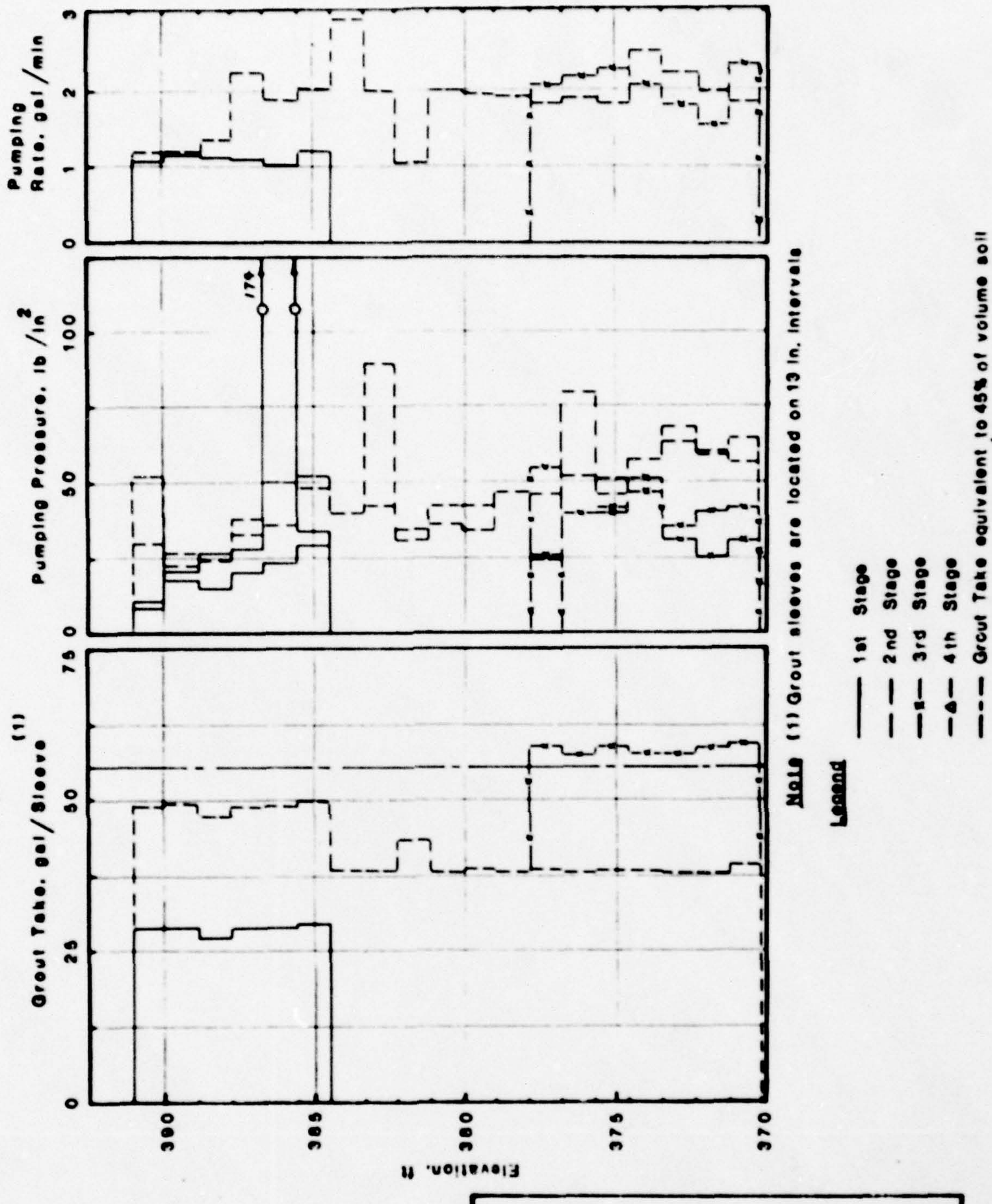
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. F-10

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

YTC825 Phase II, Vol III A

Fig. K.90



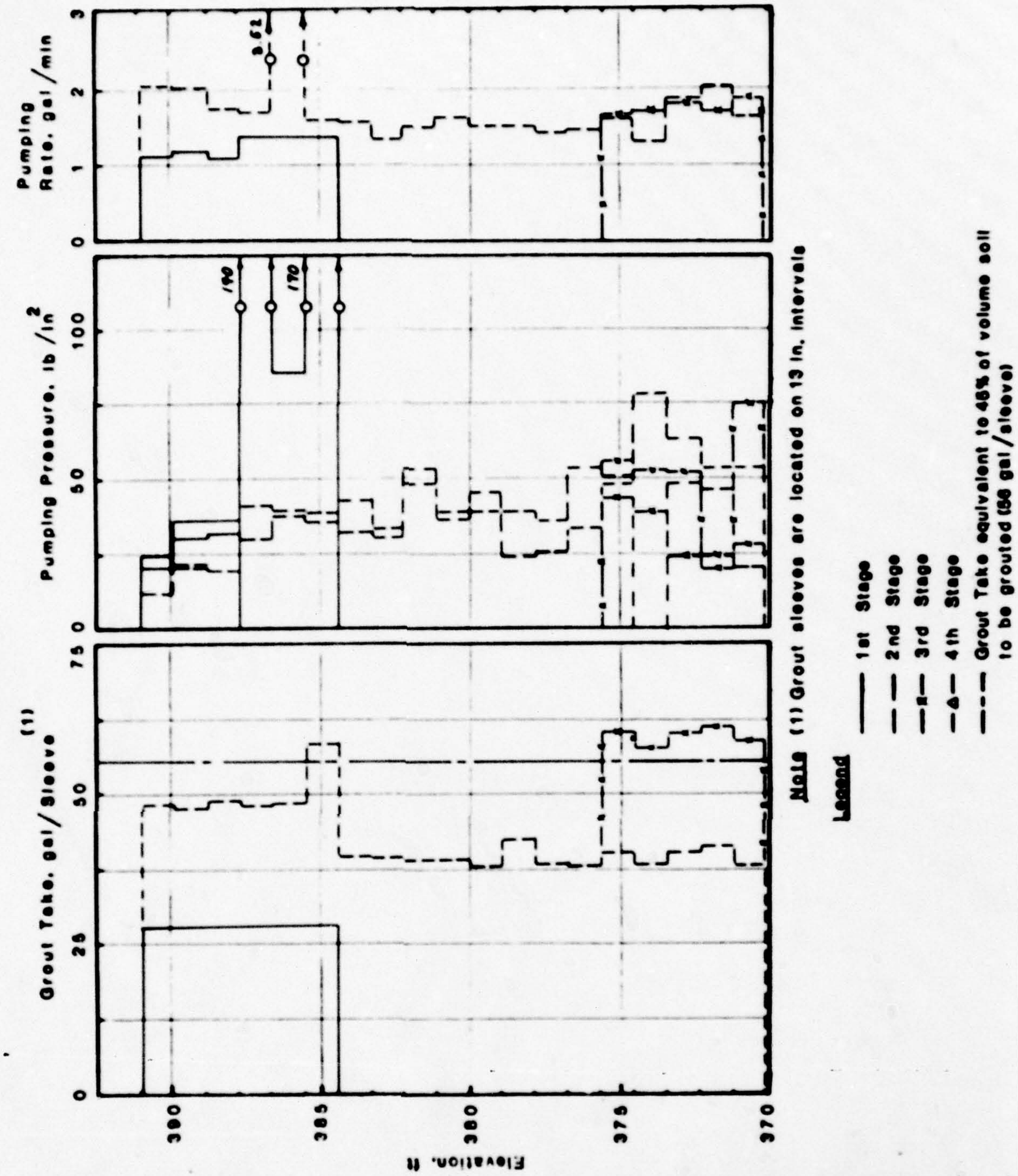
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. G-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.91



PILE DRIVING EFFECTS TEST PROGRAM

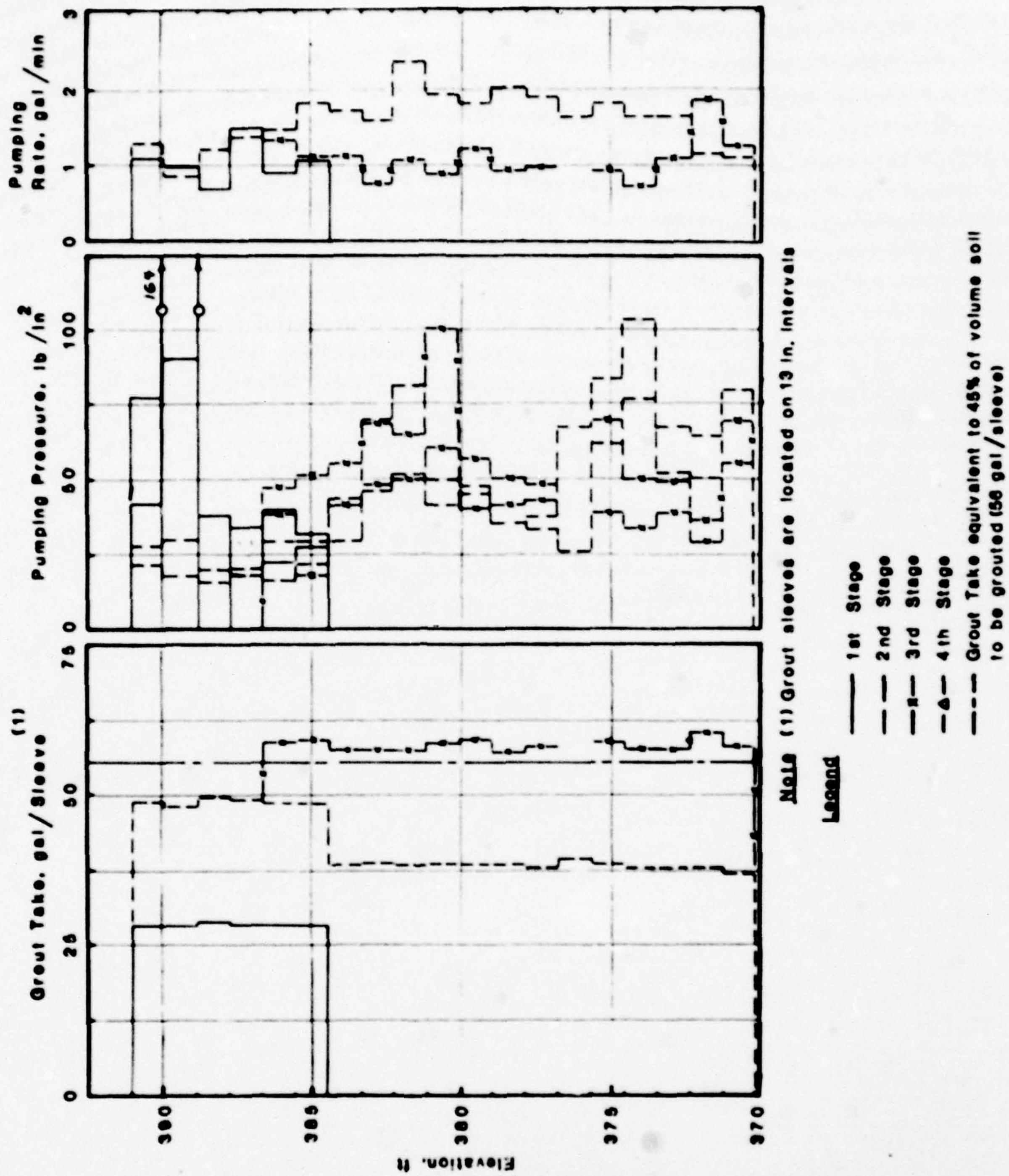
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. G-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0085

Woodward-Clyde Consultants

Fig. K.92

III, Vol III A



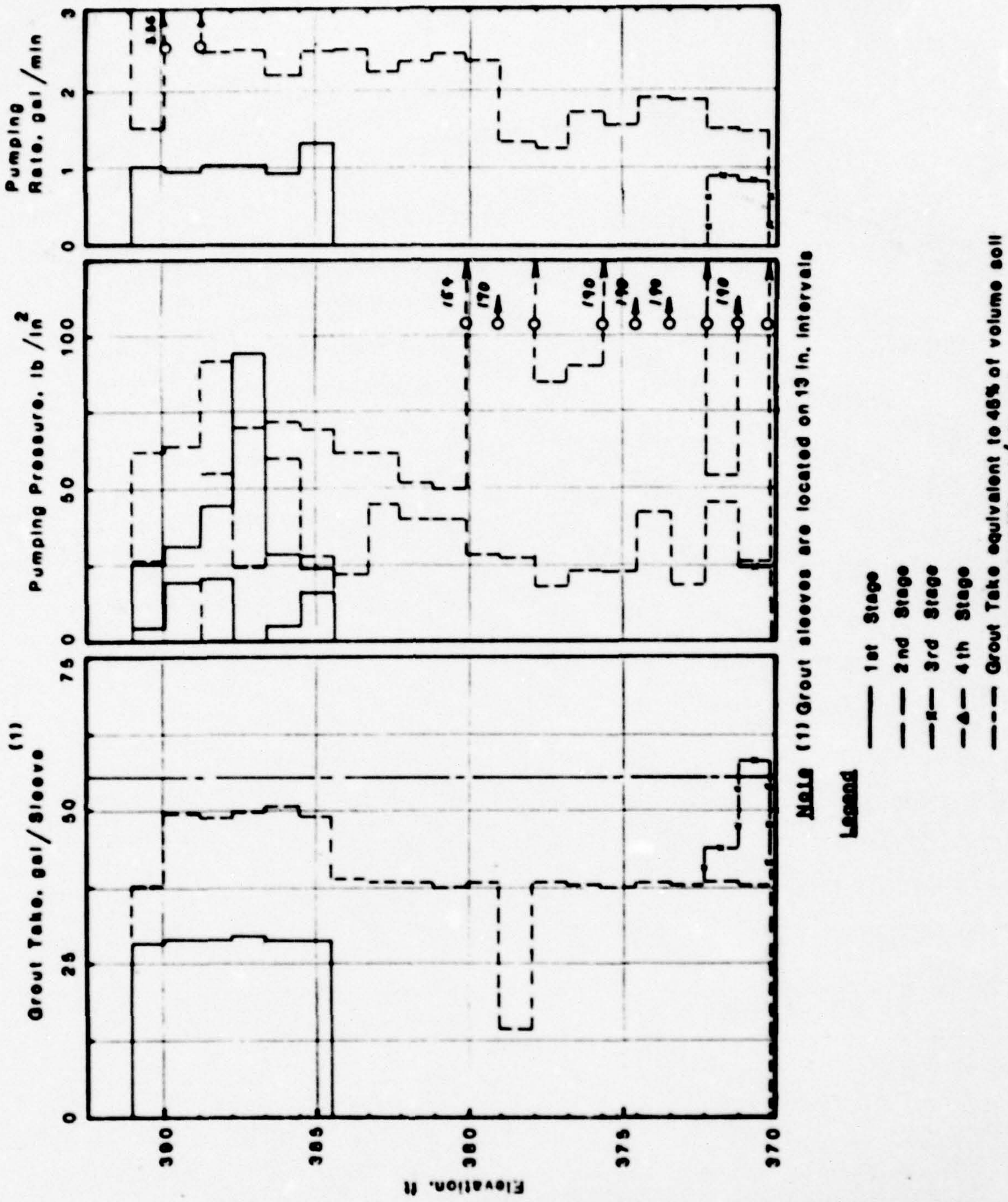
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. G-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0003

Woodward-Clyde Consultants

Fig. K.43



PILE DRIVING EFFECTS TEST PROGRAM

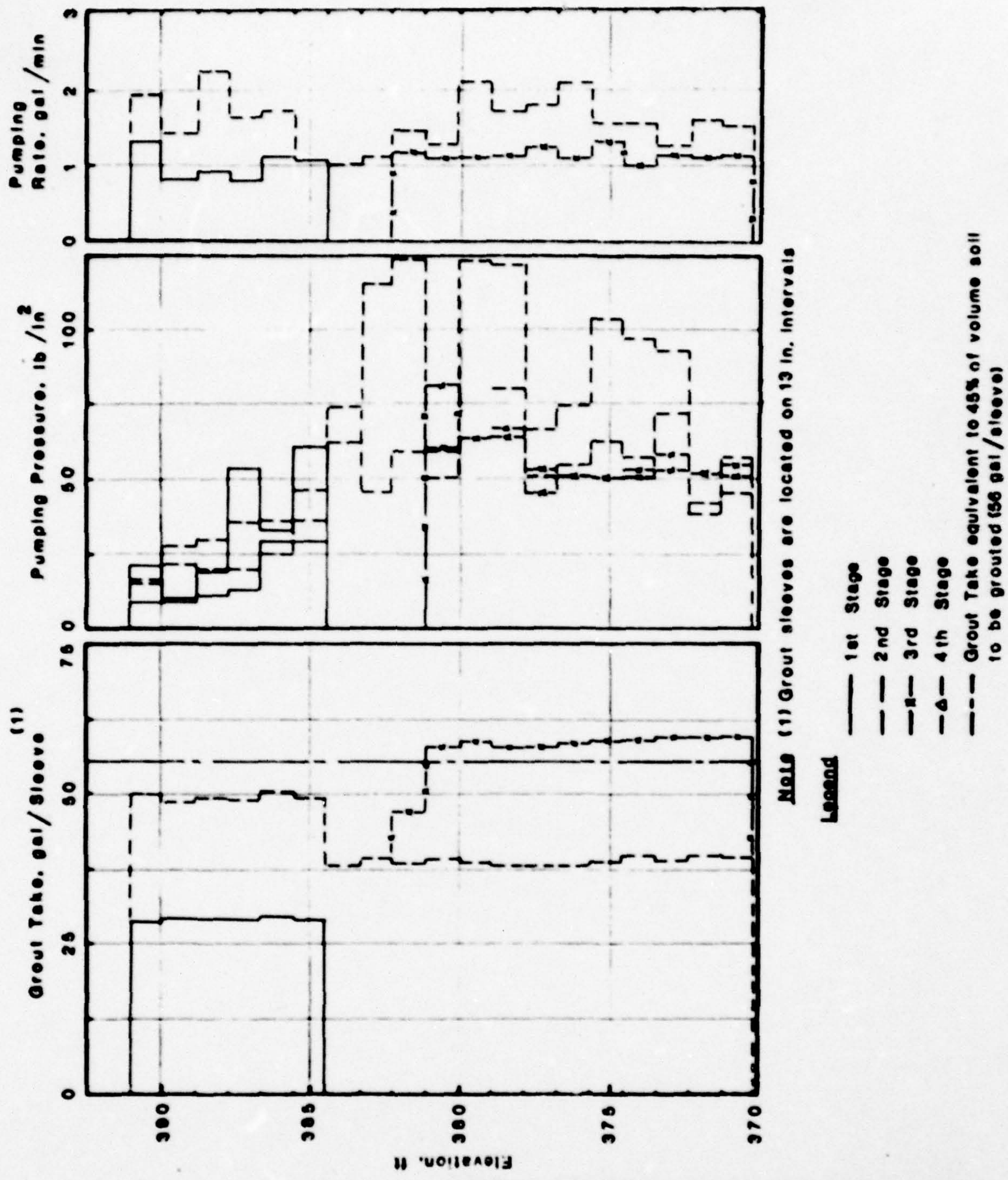
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. G-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. K.94

YTC029, Phase II, Vol III A



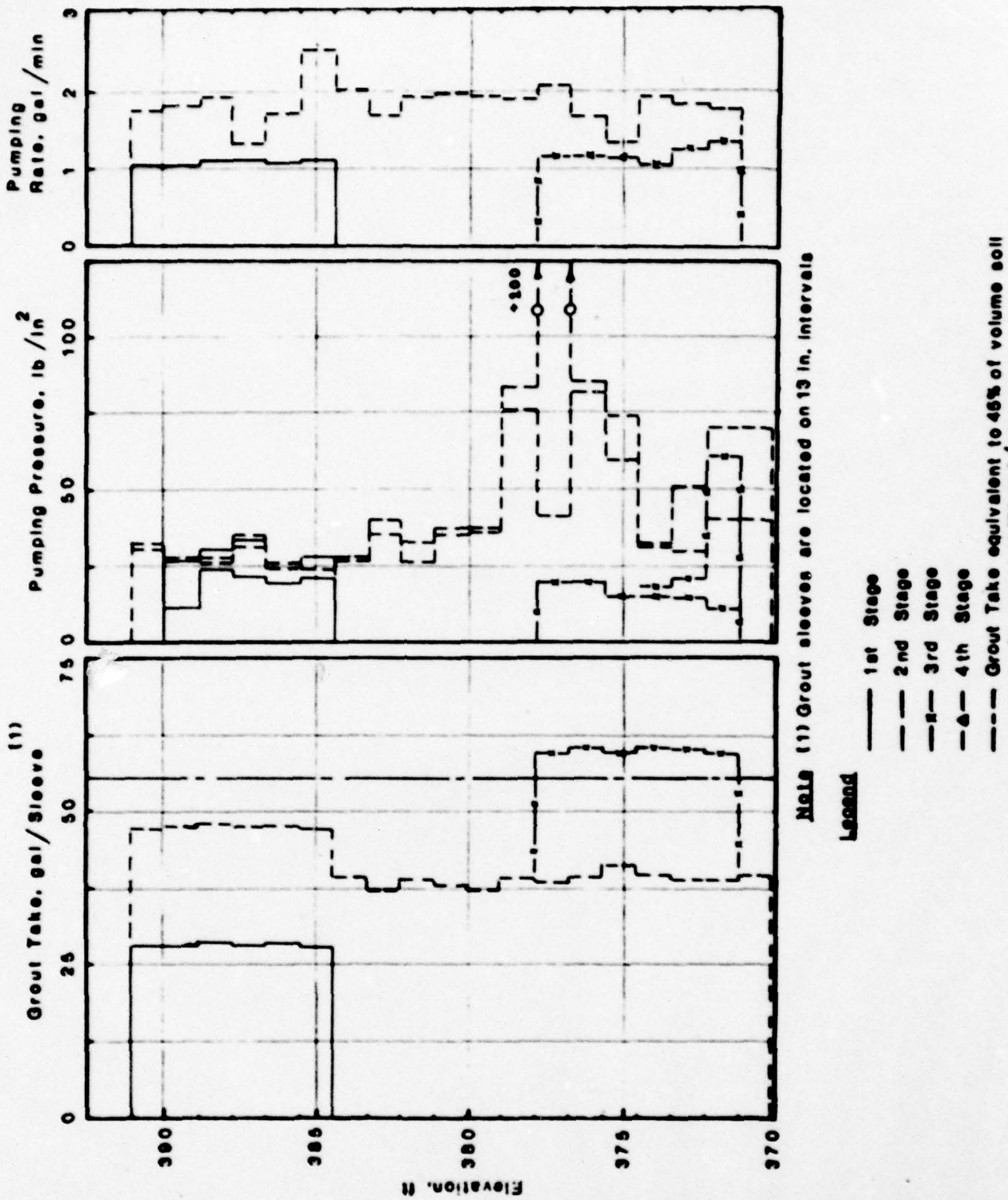
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. G-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0305

Woodward-Clyde Consultants

Fig. K.95



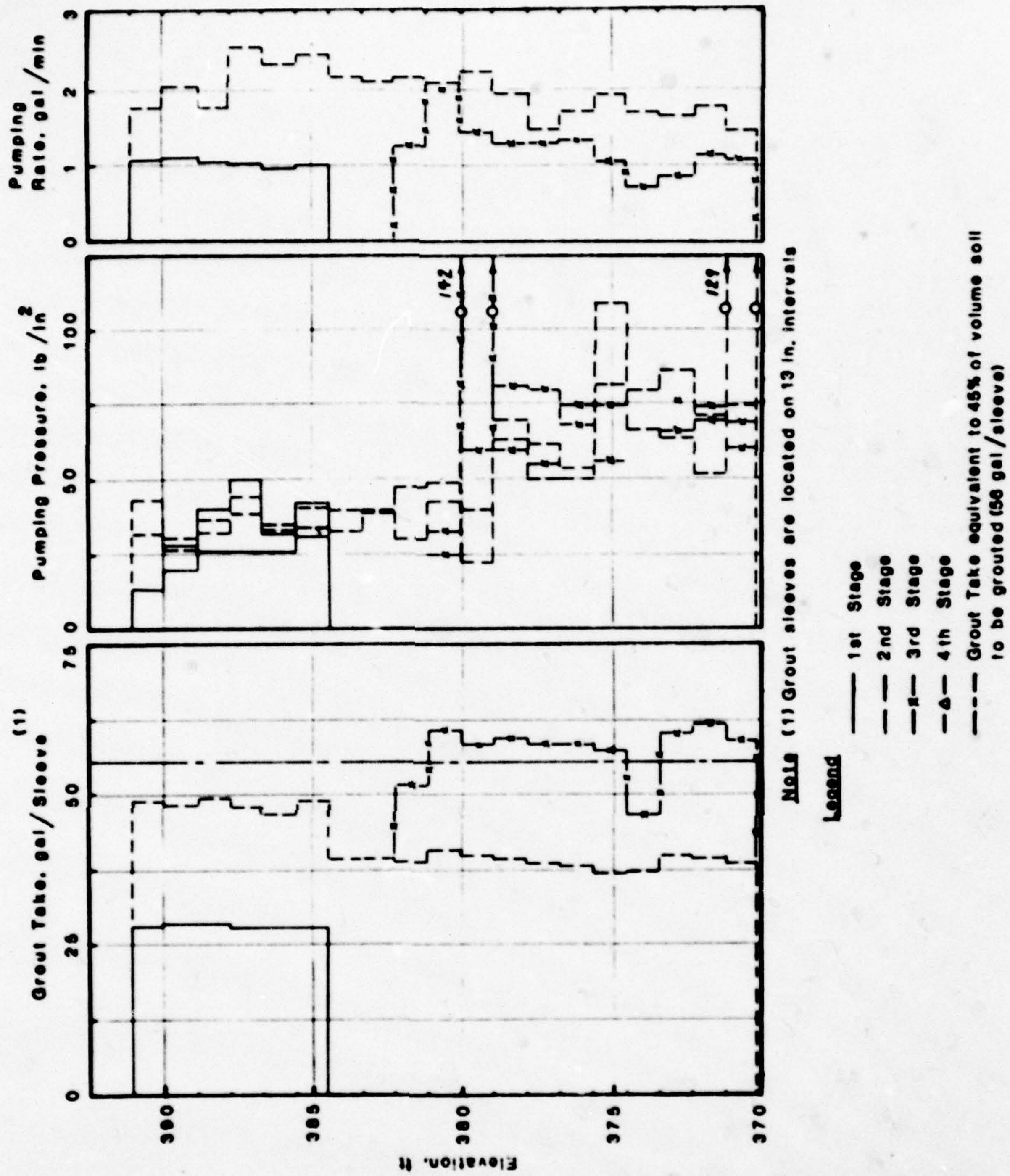
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. G-6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0065

Woodward-Clyde Consultants
77C925, Phase II ; Vol IIIA

Fig. K.96



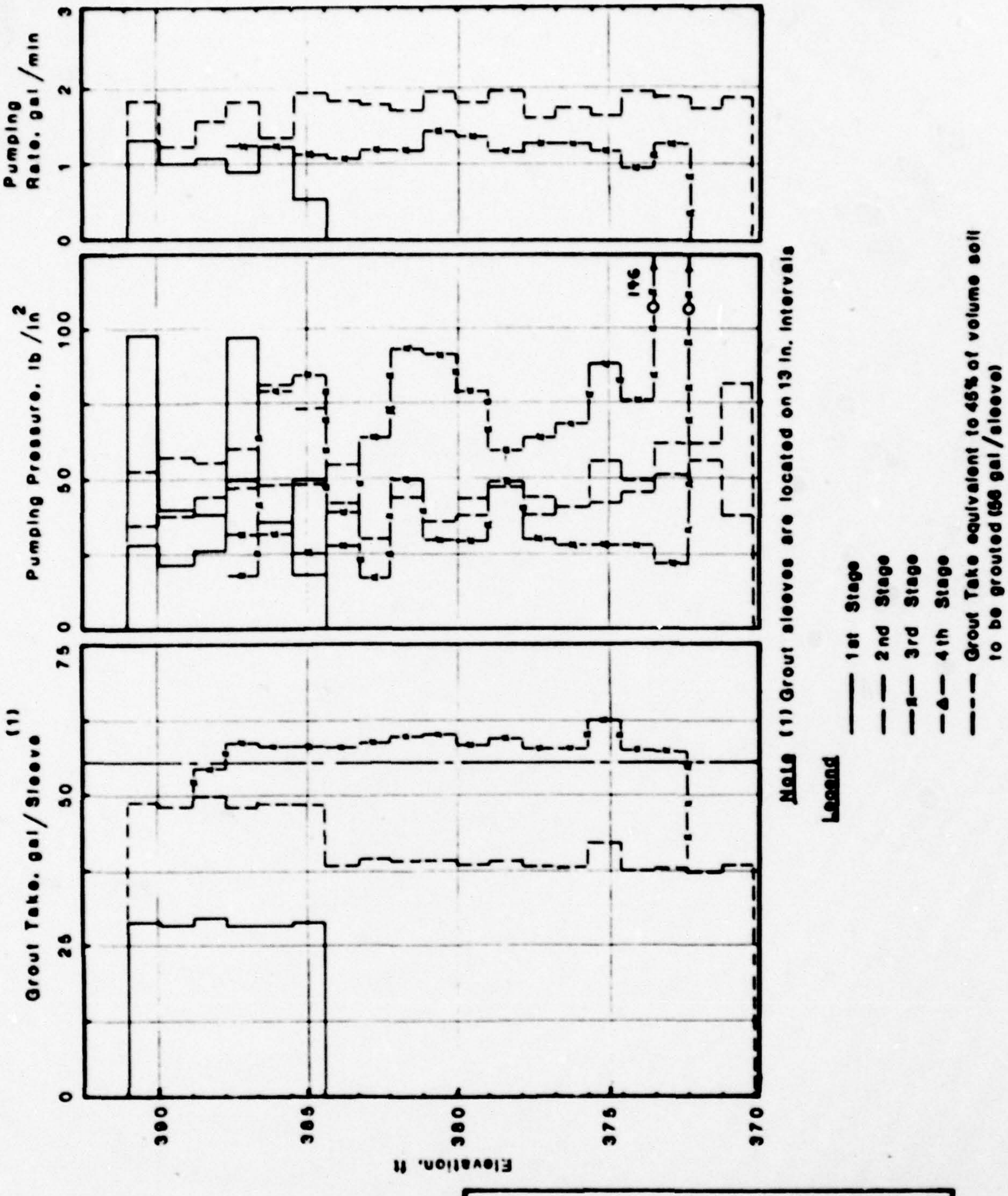
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. G-7

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0003

Woodward-Clyde Consultants

Fig. K.97



PILE DRIVING EFFECTS TEST PROGRAM

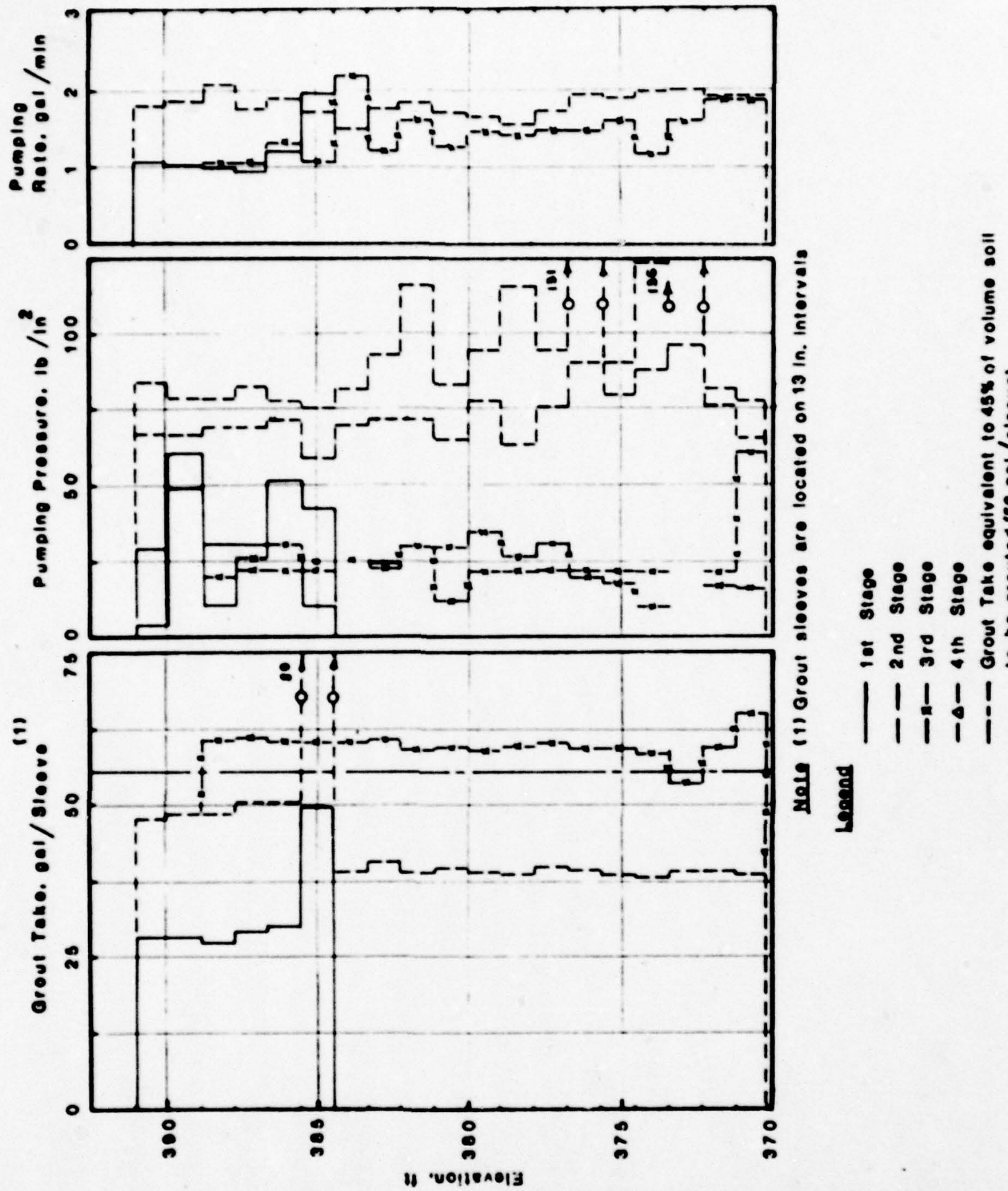
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. G-8

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0009

Woodward-Clyde Consultants

YTC825, Phase IV and III A

Fig. K.98



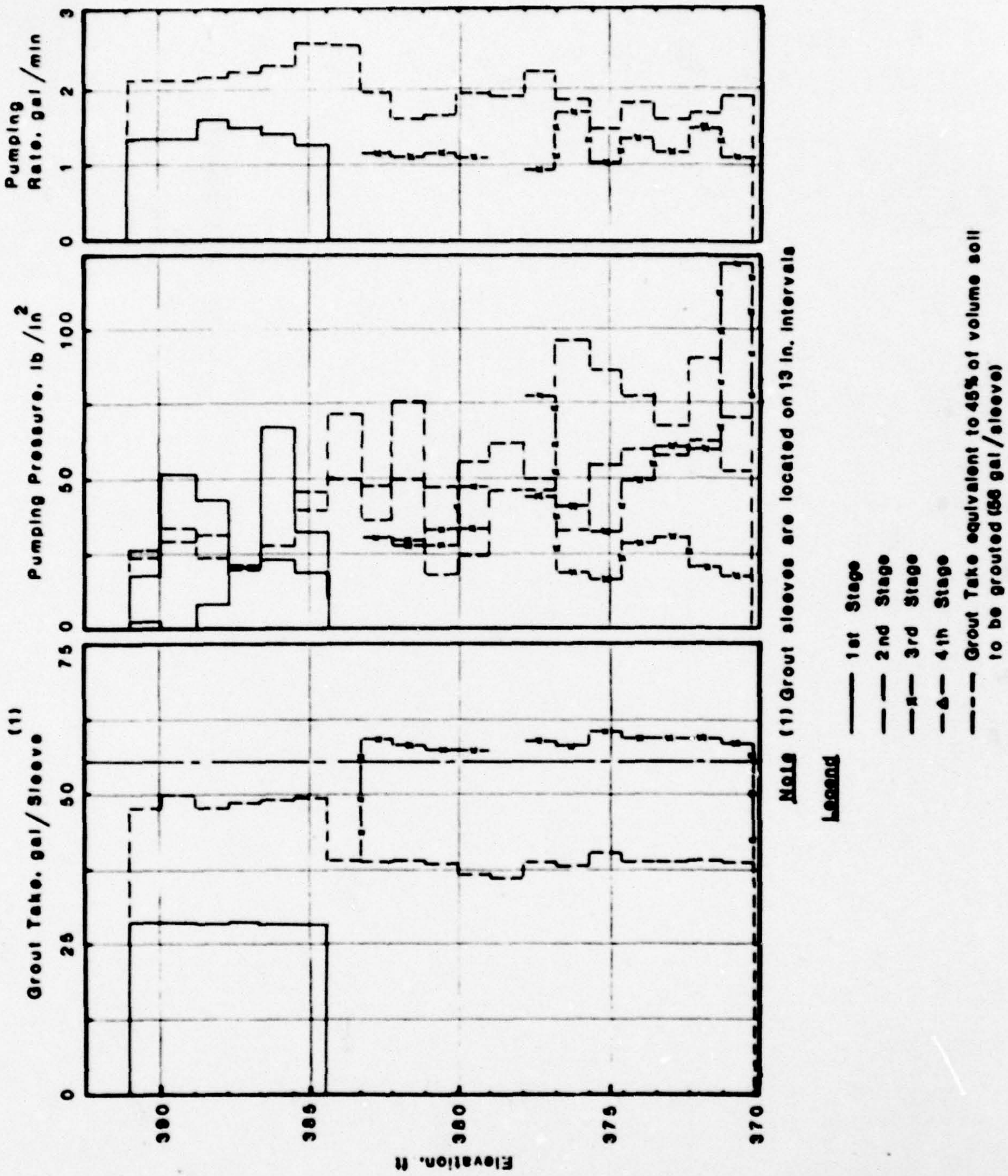
PILE DRIVING EFFECTS TEST PROGRAM

GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. G-9

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. V.99



PILE DRIVING EFFECTS TEST PROGRAM

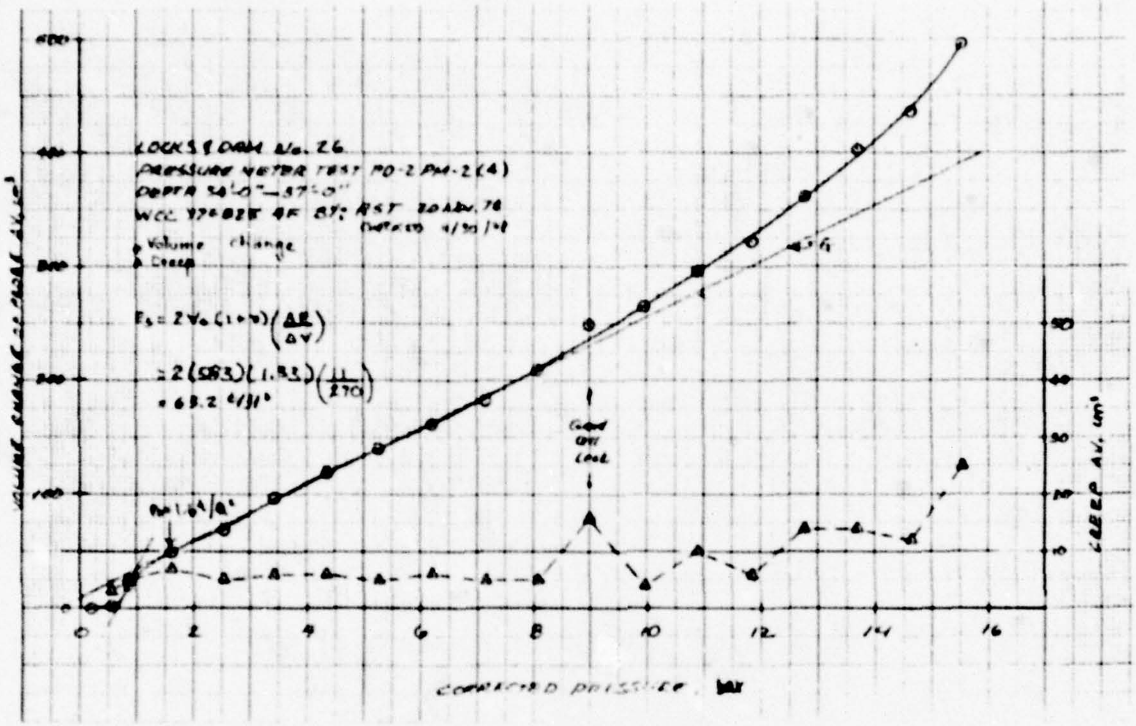
GROUT TAKE, PUMPING PRESSURE AND PUMPING RATE VS DEPTH GROUT HOLE No. G-10

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

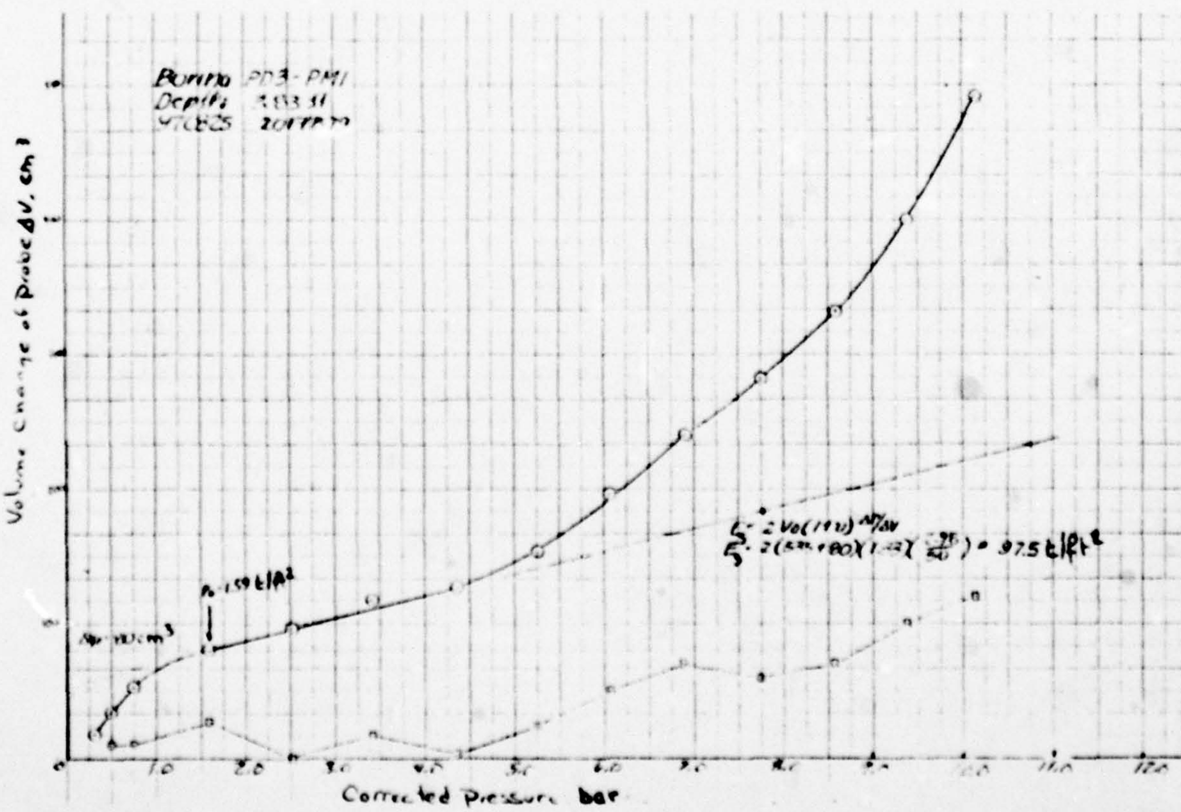
Woodward-Clyde Consultants

77C075, Phase IX; V; III A

Fig. K-100

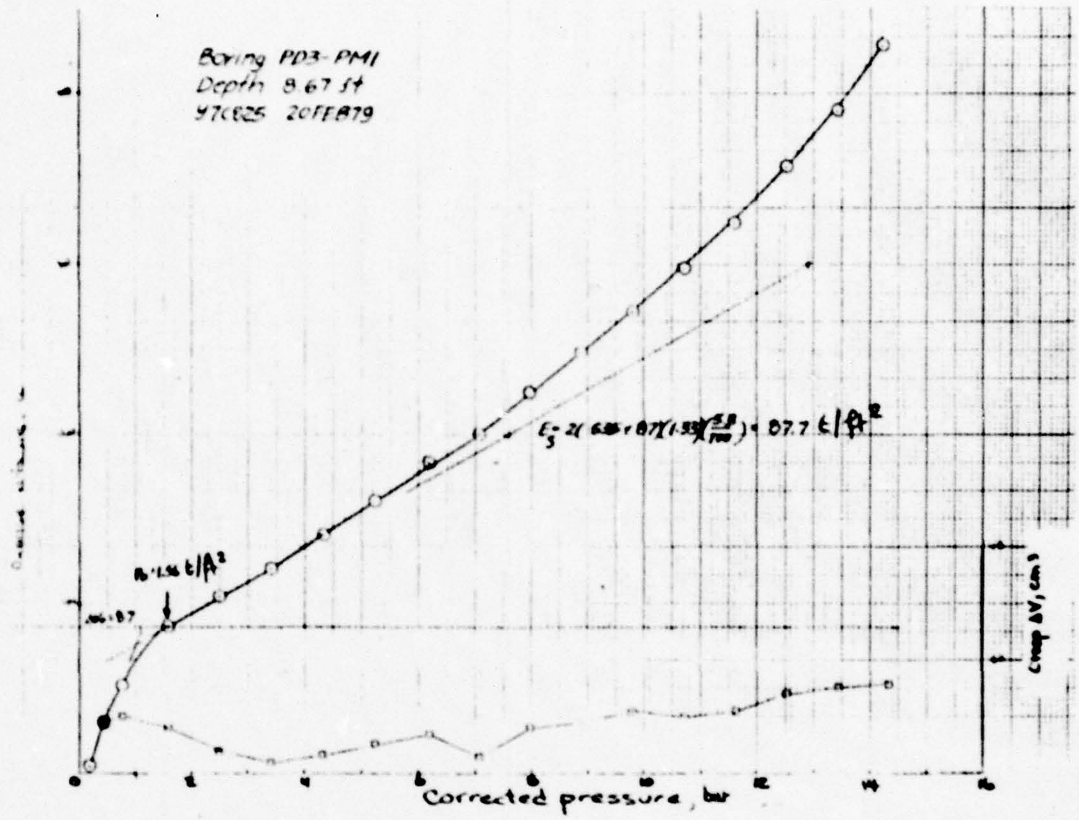


LOCKS & DAM No. 26
PRESSURE METER TEST PD-2 PM-2(4)
DEPTH 34'-0" - 37'-0"
Volume change
Creep
CORRECTED PRESSURE, bar
CREEP ΔV, cm³



Boring PD3-PM1
Volume Change of Probe ΔV, cm³
Corrected Pressure bar

1



Legend

—o— *Probe volume change versus corrected pressure*

—□— *Creep versus corrected pressure*

P_o *In situ horizontal stress*

E_s *Elastic deformation modulus*

PILE DRIVING EFFECTS TEST PROGRAM

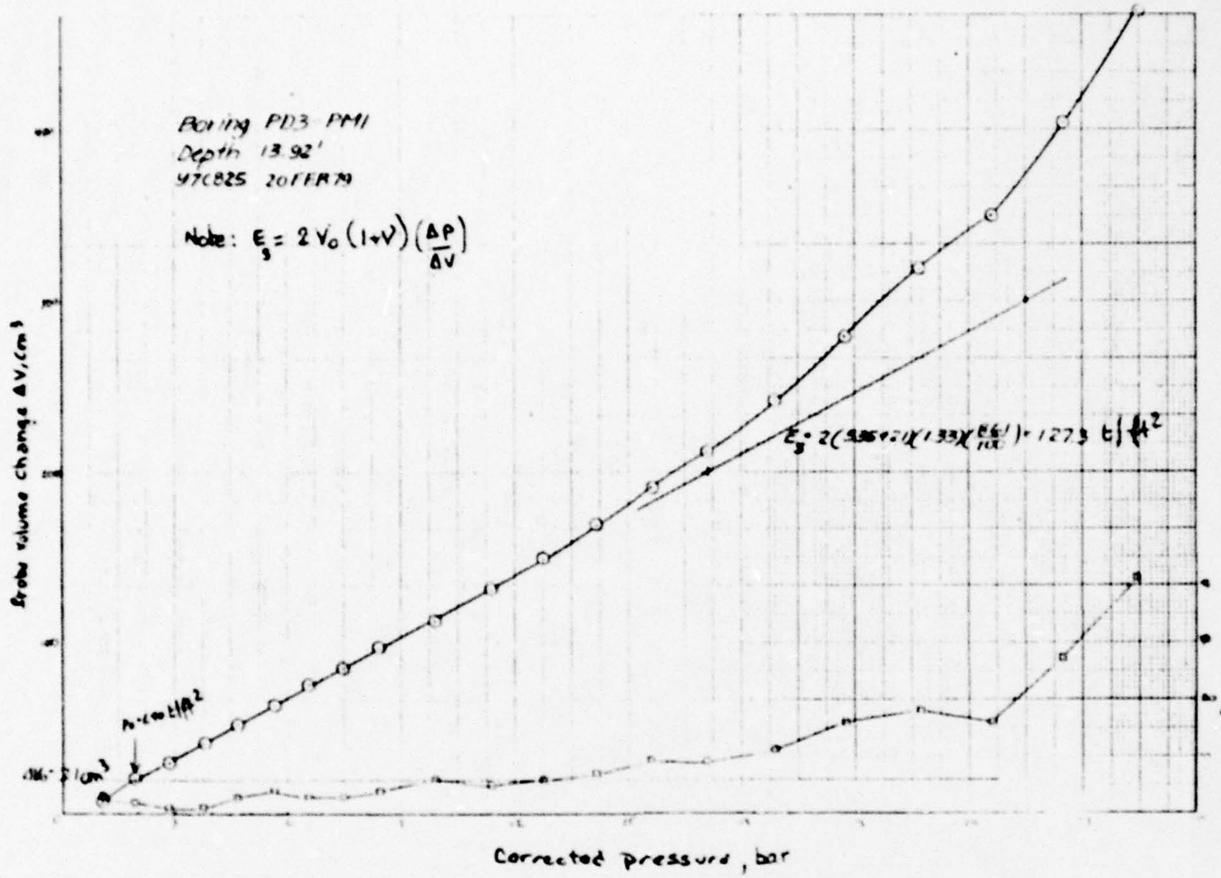
PRESSUREMETER TEST RESULTS AFTER GROUTING

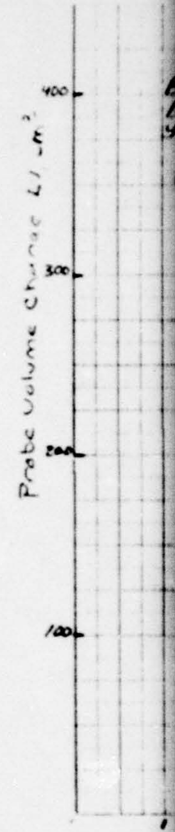
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

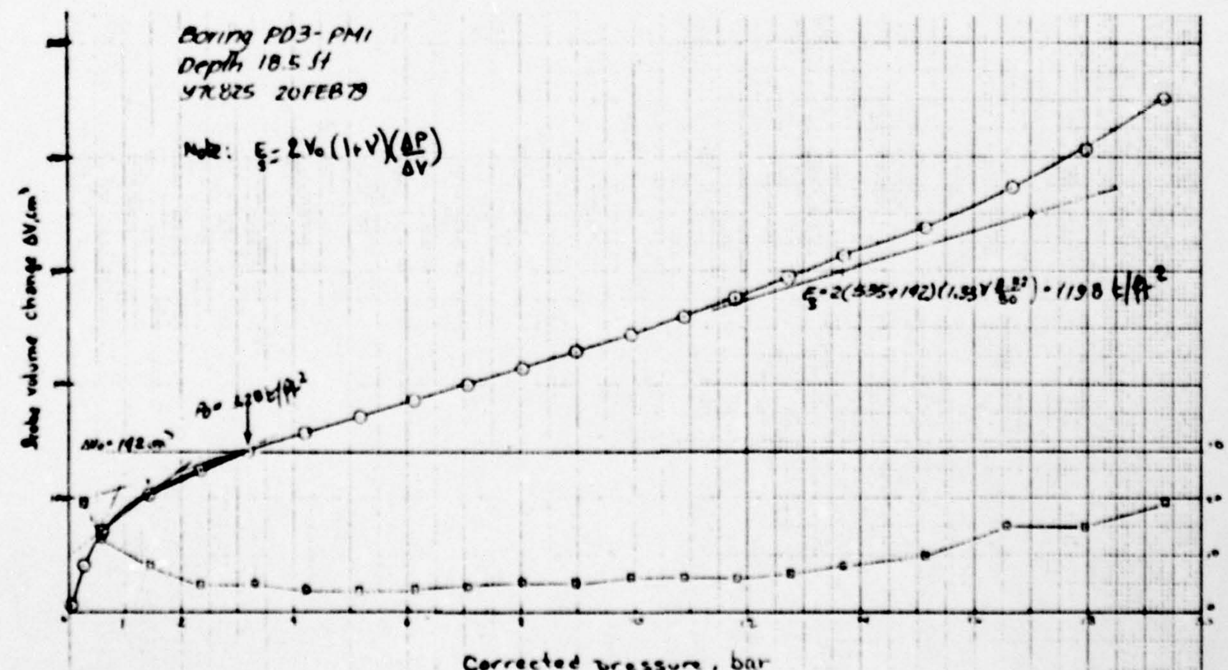
Woodward-Clyde Consultants
77C825, Phase III ; Vol IIIA

Fig. K.101

1 2

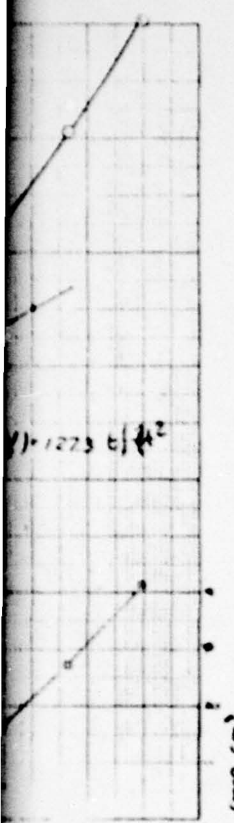

Boring PD3 PM1
Depth 13.92'
Y7C825 20FEB79
Note: $E_s = 2V_0(1+\nu)\left(\frac{\Delta P}{\Delta V}\right)$
Probe volume change ΔV, cm³
Creep, cm³
Corrected pressure, bar

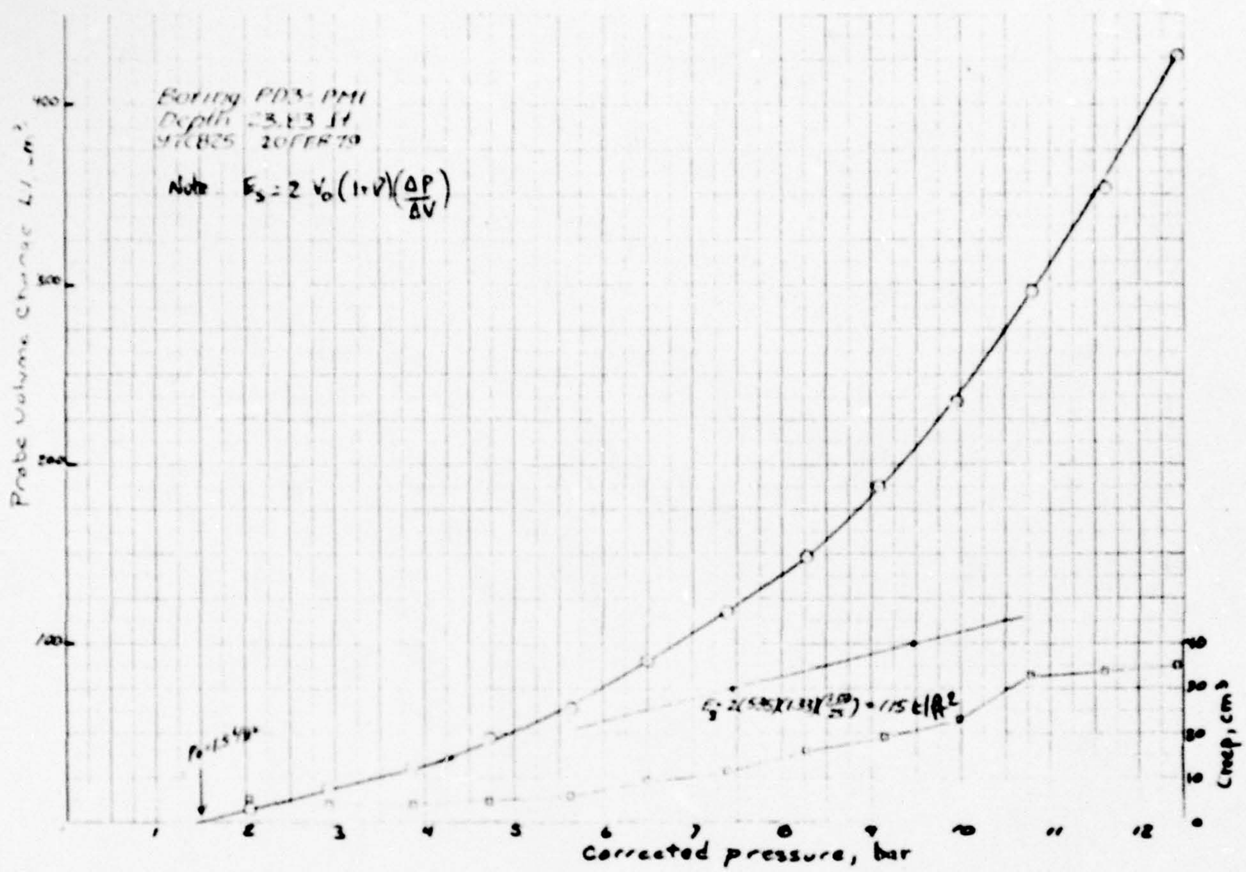

Probe Volume Change
400
300
200
100

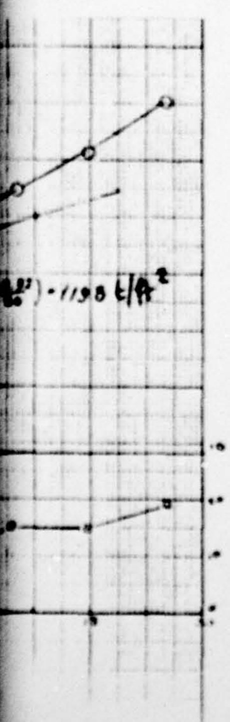

Boring PD3-PM1
Depth 18.5 ft
Y7C825 20FEB79
Note: $E_s = 2V_0(1+\nu)\left(\frac{\Delta P}{\Delta V}\right)$
Probe volume change ΔV, cm³
Creep, cm³
Corrected pressure, bar

P_0 In
E_s El

1







Legend

-o- Probe volume change versus corrected pressure

-□- Creep versus corrected pressure

P_o In situ horizontal stress

E_s Elastic deformation modulus

PILE DRIVING EFFECTS TEST PROGRAM

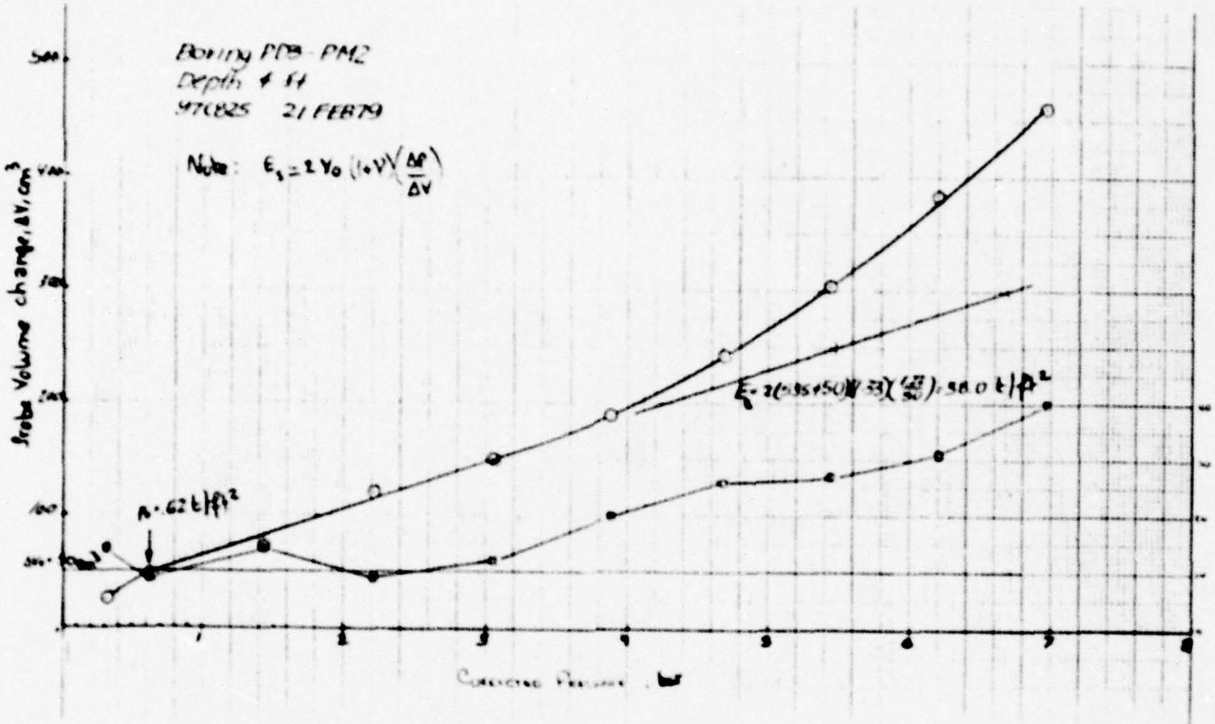
PRESSUREMETER TEST RESULTS AFTER GROUTING

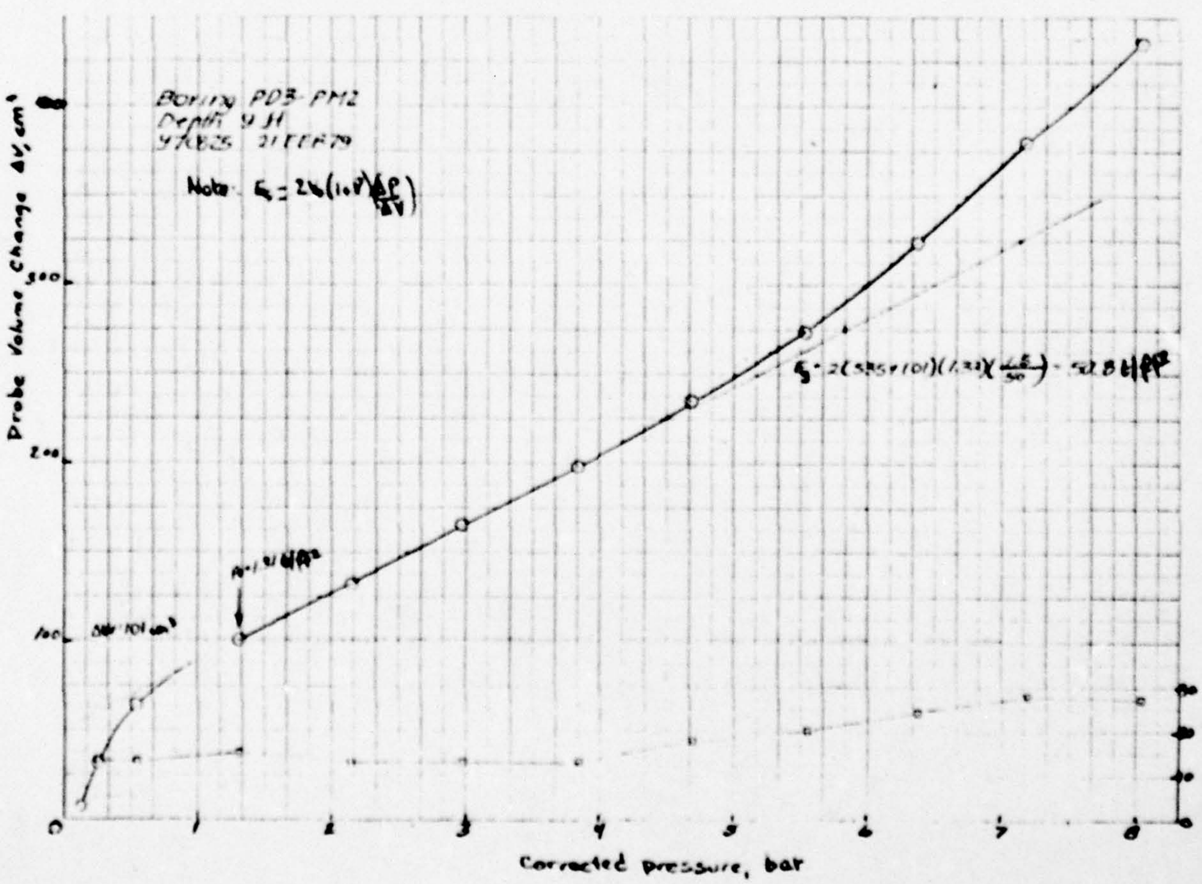
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS

Woodward-Clyde Consultants

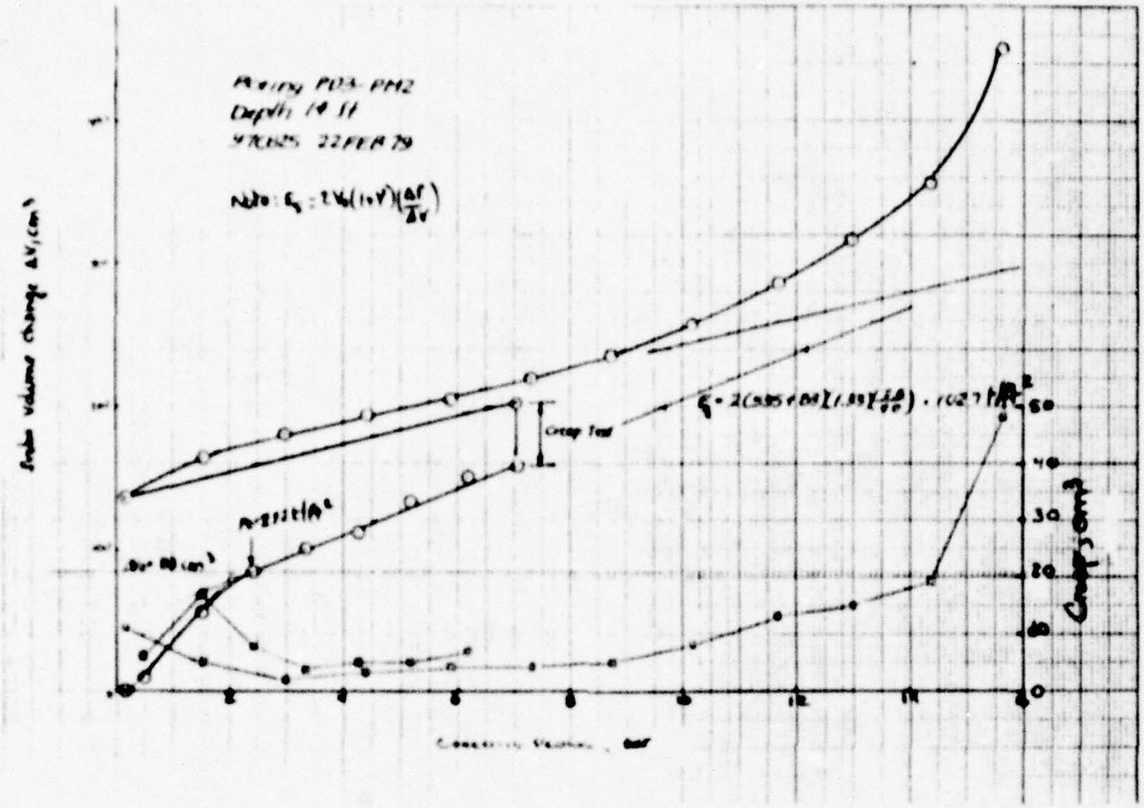
Fig. K.102

1 2


Boring PD3-PM2
Depth 4 ft
97C825 21 FEB79
Note: $E_s = 2V_0(1+\nu)\left(\frac{\Delta P}{\Delta V}\right)$
$E_s = 2(535+50)(1.33)\left(\frac{1.0}{50}\right) = 38.0$ t/ft²
Probe Volume change, ΔV, cm³
Probe Volume change ΔV, cm³
Creep, cm³
Corrected Pressure, bar


Boring PD3-PM2
Depth 9 ft
97C825 21 FEB79
Note: $E_s = 2V_0(1+\nu)\left(\frac{\Delta P}{\Delta V}\right)$
$E_s = 2(535+101)(1.33)\left(\frac{1.5}{50}\right) = 52.8$ t/ft²
V_0 = 101 cm³
Probe Volume Change ΔV, cm³
Creep cm³
Corrected pressure, bar

1



Legend

-o- *Probe volume change versus corrected pressure*

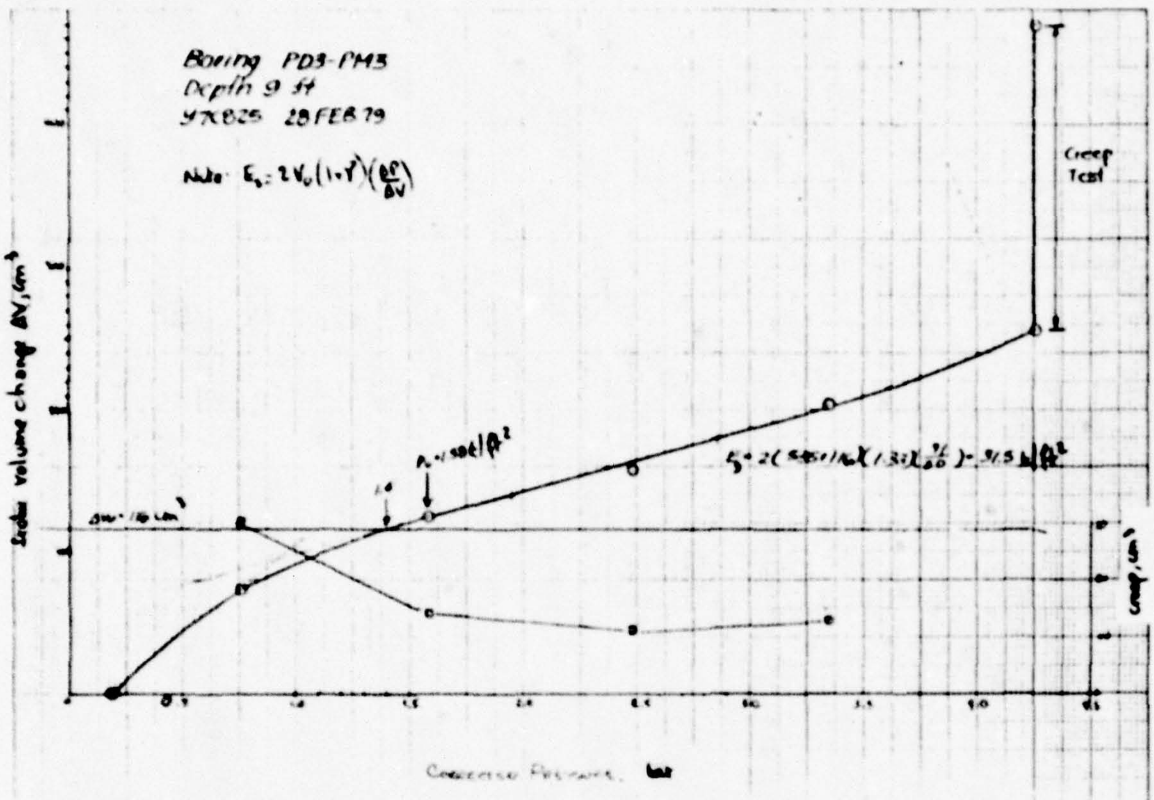
-□- *Creep versus corrected pressure*

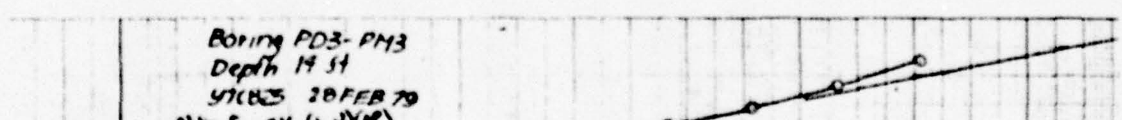
P_o *In situ horizontal stress*

E_E *Elastic deformation modulus*

PILE DRIVING EFFECTS TEST PROGRAM
PRESSUREMETER TEST RESULTS AFTER GROUTING
FOUNDATION INVESTIGATION AND TEST PROGRAM EXISTING LOCKS AND DAM No. 26 ST. LOUIS DISTRICT, CORPS OF ENGINEERS DACW43-79-C-0003
Woodward-Clyde Consultants — Fig. K.103

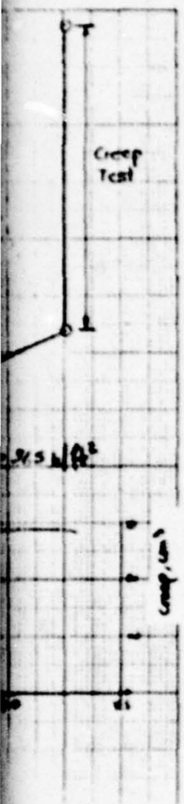
2

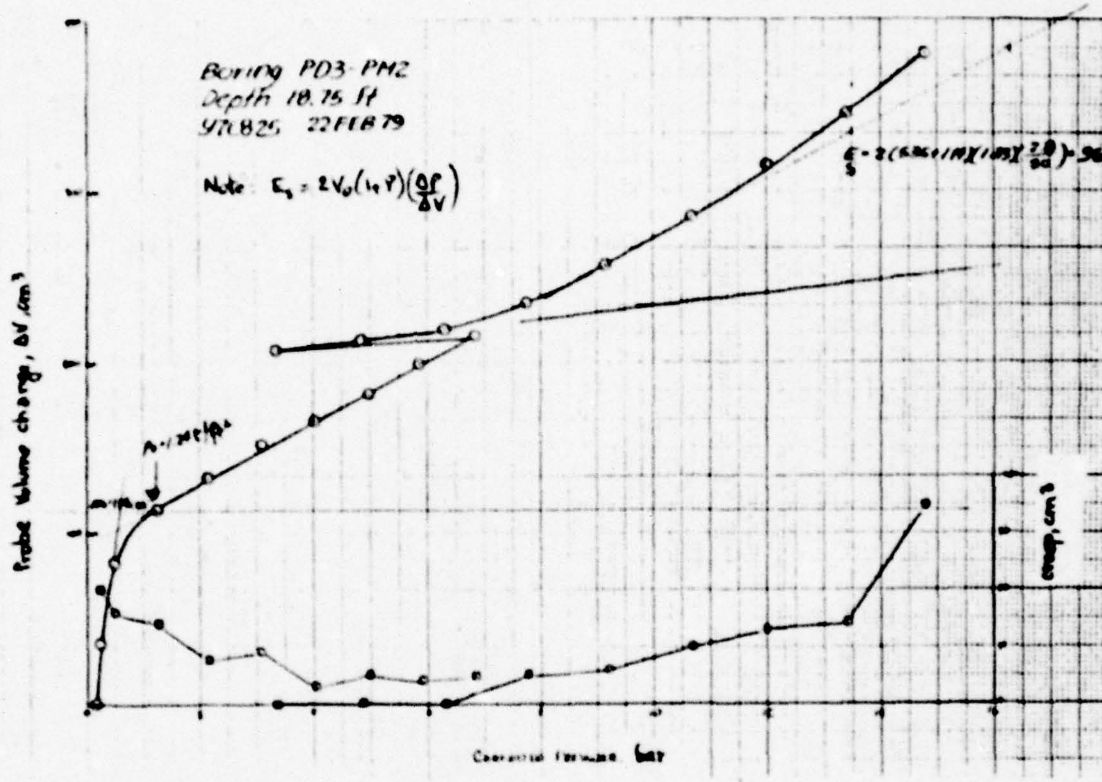




Probe volume change, ΔV, cm³

Lege
—o—Probe vol
correcte
—□—Creep ve
pressure
P_0 In situ h
E_s Elastic d
modulus





Legend

—o— Probe volume change versus corrected pressure

—▫— Creep versus corrected pressure

P_0 In situ horizontal stress

E_s Elastic deformation modulus

PILE DRIVING EFFECTS TEST PROGRAM

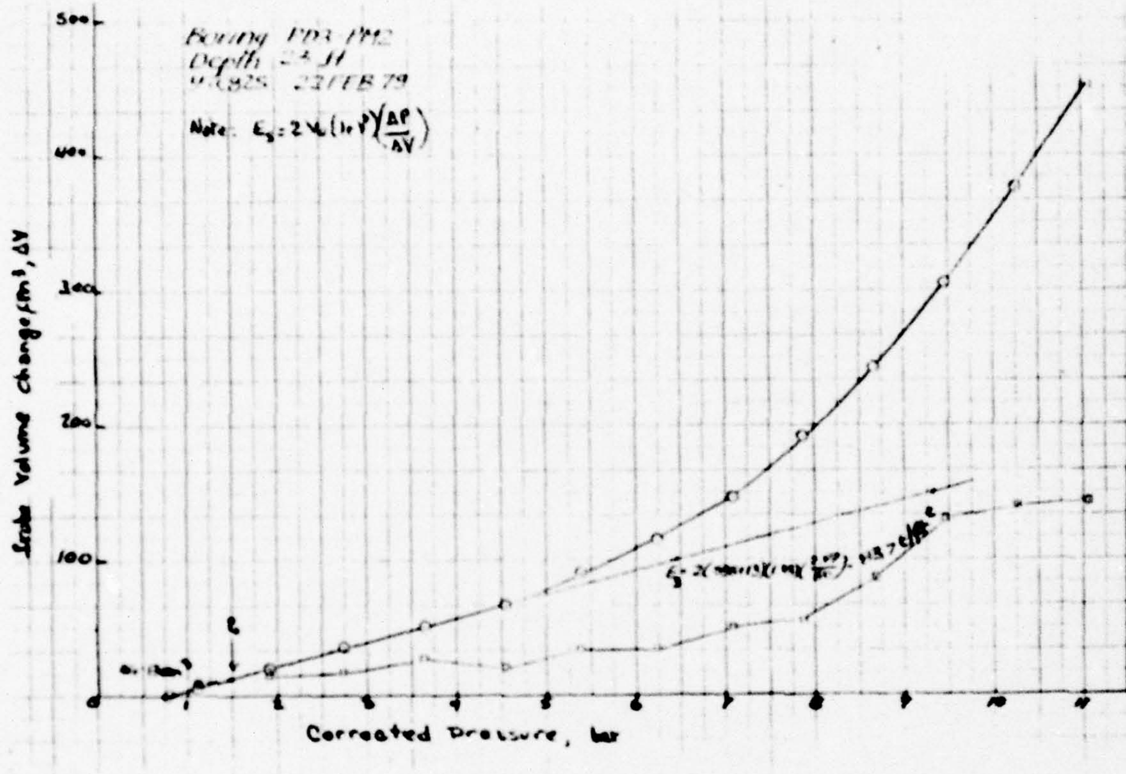
PRESSUREMETER TEST RESULTS AFTER GROUTING

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0009

Woodward-Clyde Consultants

Fig. K.104

1 2



Legend

—o— Probe volume change versus corrected pressure

—□— Creep versus corrected pressure

P_o In situ horizontal stress

E_s Elastic deformation modulus

PILE DRIVING EFFECTS TEST PROGRAM	
PRESSUREMETER TEST RESULTS AFTER GROUTING	
FOUNDATION INVESTIGATION AND TEST PROGRAM EXISTING LOCKS AND DAM No. 26 ST LOUIS DISTRICT, CORPS OF ENGINEERS. DACW43-78-C-0005	
Woodward-Clyde Consultants ST C 025, Phase III, Vol III A	Fig. K.105

PHASE IV REPORT

VOLUME IIIA

RESULTS AND INTERPRETATION OF
PILE DRIVING EFFECTS TEST PROGRAM

APPENDIX L

MEASUREMENT DETAILS
MONOLITH M1

TABLE OF CONTENTS

YTC-825
Phase IV; Vol. III A

L MEASUREMENT DETAILS, MONOLITH M1

L.1 COMPLETE FIELD LOGS OF INSTALLATION OF TIMBER PILES SURROUNDING MONOLITH M1

The identification number (Id. No.) at the top right-hand corner of each data sheet includes the timber pile number shown in Fig. 5.2, Volume III

The timber pile number is given by the two digits preceeding the last two zeros of the Id. No. (for example, page L-2 corresponds to timber pile No. 52)

The field logs are presented in chronological order of timber pile installation

L-

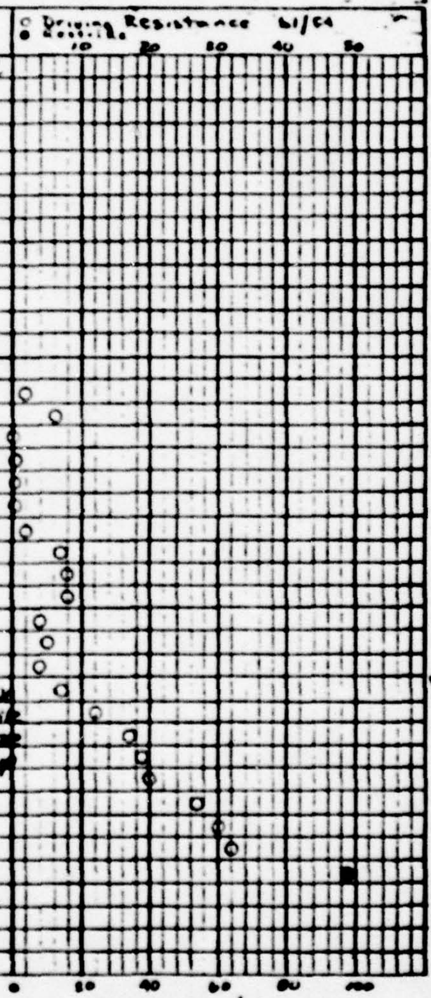
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 03 01 160 1 5200

Pile Type Oak   Hammer Vulcan V-1   Date 12 Oct. 1978
Pile length 42'   Energy 15,000   Time 13:15~14:50
Ground el. trench level   Operating Rate 60 B/min   Inspector GEL

Time

Depth ft	Blows	Remarks
0-1		13:25 jetting started
2		
3		
4		
5		
6	jet	
7		
8		
9		
10		
11		
12		
13		
14		
15	2	w/ jet to 28'
16	6	
17	0	
18		
19	1	one blow.
20		
21	2	
22	7	
23	8	
24	8	
25	4	
26	5	
27	4	
28	7	jet stopped going down
29	12	some boiling near to pile
30	17	being driven, looked like
31	19	the water was coming up
32	20	the instrumentation
33	27	drill hole.
34	30	
35	21 for 8"	
	49/12" restrike 10/13/78	



□ Capacity kips
■ Restrike
▽ Jetting depth

Dynamic measurements no

Sequence No	Depth ft

Notes:
Pile batter at 5.0.0
2.3% S
2.0% E

WCC, 77C815, Phase II
Vol III A

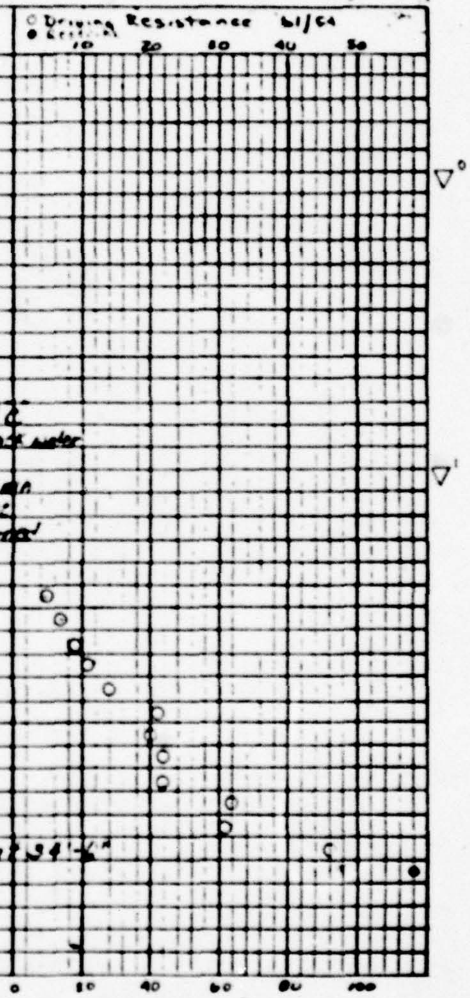
J.H.C.I.
10oct'78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 03 01 160 1 5300

Pile Type Oak | Hammer Vulcan V-1 | Date 12 Oct. 1978
Pile length 42' | Energy 15,000 | Time 16:00 ~ 16:45
Ground el. trench level | Operating Rate 60 bl/min | Inspector - Simon Kirch

Depth ft	Blows	Remarks
0-1		
2		
3		pre-jetted
4		
5		
6		
7		
8		
9		
10		
11		
12	jetted	
13		pile walked ~ 6"
14		
15		
16		pile jumped ~ 6" toward ℄
17		small pieces of clay in back water
18		
19		lost circulation for ~ 2 min
20		pile dropped from 19 ft
21		to 23. Circulation returned
22		
23		
24	5	jet extracted
25	7	
26	9	
27	11	
28	14	
29	21	
30	20	
31	22	
32	22	
33	32	
34	31	
35	27 for 7"	Started to get hard at 34'-6"
	29/6"	restrike 10/13/78



□ Capacity kips
● Restrike
∇ Jetting Depth

Dynamic Measurements no

Sequence No	Depth ft

Notes:
Pile batter at E.O.D.
6.5% N
1.0% E

WCC, VTC BIS, Phase II
VOL III A

J.H.C.J.
10 Oct '78

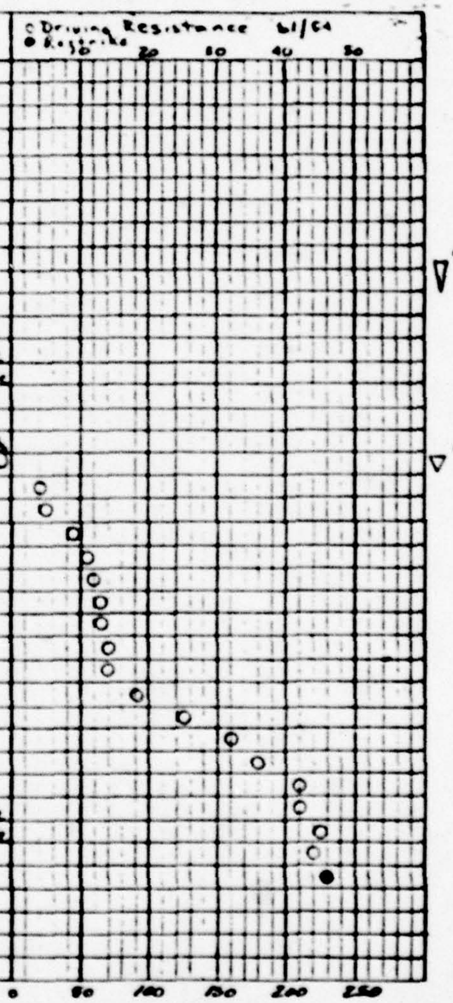
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 5400

Pile Type OAK Hammer Vulcan V-1 Date 12 Oct 78
Pile length 42' Energy 15,000 Time 1830 → 2025
Ground el. trench level Operating Rate 60 bl/min Inspector - Simon Kirch

Depth ft	Blows	Remarks
0-1		18:30
2		pre-jetted 10ft
3		
4		
5		
6		
7		
8		
9		Pile sinks w/Jetting
10		
11	Jetted	
12		Having trouble getting pile down
13		Ran jet down either side of pile
14		pile moving w/jet pipe at tip of pile
15		[illegible] jet [illegible] down pile
16		Jet running a [illegible]
17		Pile moving w/great difficulty
18		No circulation
19	4	20:00
20	5	
21	9	
22	11	
23	12	
24	13	Change stroke rate [illegible] bl/min
25	13	
26	14	
27	14	
28	18	
29	25	48 bl/min
30	32	
31	36	47 bl/min
32	42	
33	25/6" 35	Stopped to remove chocks + toggle
34	45	blocks which have burned @ pile
35	44	20:25
	25/6"	restrike 10/13/78



Dynamic measurements no

Sequence No.	Depth ft

Notes:
Pile water at F.O.O.
0.7% N
4.0% W

□ Capacity, Kips
● Restrike
▽ Jetting Depth

J.H.C.L.
10 Oct 78

WCC, 77C 825, Phase II
Vol III A

L-5

F. ...

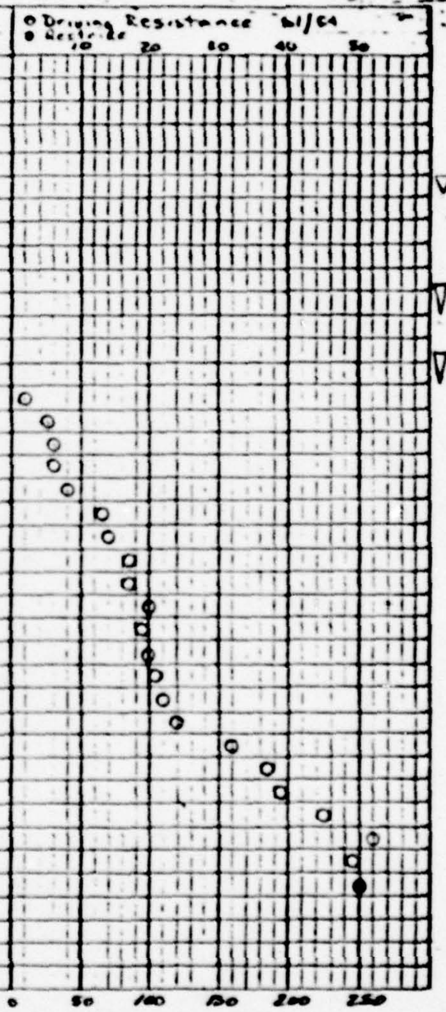
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No 03 01 160 1 5500

Pile Type	OAK	Hammer	Vulcan V-1	Date	13 Oct 78
Pile length	42'	Energy	15,000	Time	0900 - 0925
Ground el.	trench level	Operating Rate	60 bl/min	Inspector	Locke/Holloway

Depth ft	Blows	Remarks
0-1	↓	
2		
3		Prejetted
4		
5		
6		
7		
8	Jetted	
9		
10		
11		
12	3 blows w/jet 2	
13		
14	↓	last jet circulation ceased
15	2	jetting
16	5	
17	6	
18	6	
19	8	
20	13	
21	14	
22	17	
23	17	
24	20	
25	19	
26	20	
27	21	
28	22	
29	24	
30	32	pulled toggles
31	37	
32	39	
33	45	
34	52	
35	49	
	25/6"	restrike 10/14/78
	75	



Dynamic measurements no

Sequence No.	Depth ft

Notes: Tip Φ 8"
(see overside)
Pile batter at E.O.D.
2.7% N
2.4% W

□ Capacity, kips
■ Restrike
∇ Jetting Depth

WCC, 77C 815, Phase II
Vol III A

[signature]
10 Oct 78

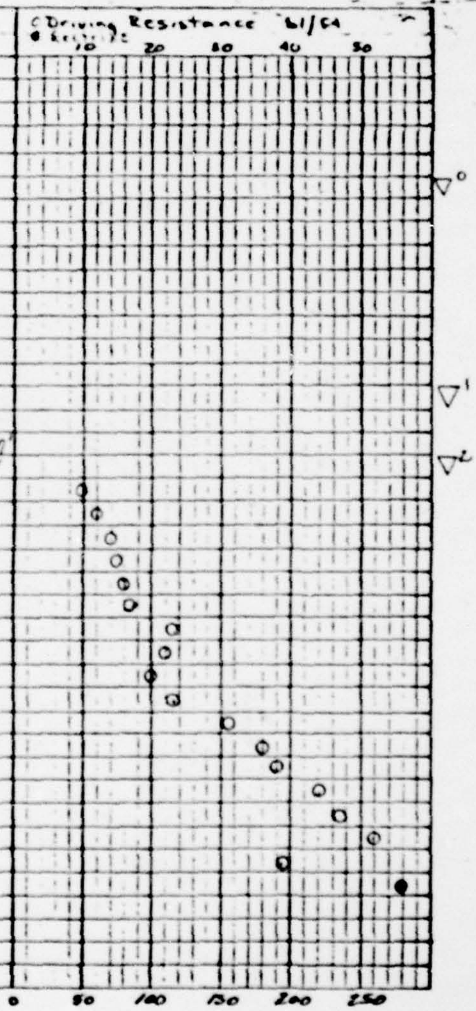
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 6300

Pile Type	Oak	Hammer	Vulcan V-1	Date	13 Oct 78
Pile length	42' 1"	Energy	15,000	Time	1025 → 1115
Ground el.	Trench Level	Operating Rate	60 bl/min	Inspector	Hollowisu/Kech

Depth ft	Blows	Remarks
0-1		10:25
2		
3		Pile sinks 6'
4		
5		
6		
7		Jet to 18'
8		
9		
10		
11		Jet 3' above tip at 11'
12		
13		
14		
15		
16		
17		Clay particles appear at 17'
18		Jet pipe 4' above tip at 18'
19	10	and not moving, pile not
20	12	moving; did not have
21	14	penetration
22	15	
23	16	
24	17	
25	23	
26	22	
27	20	
28	23	
29	31	
30	36	
31	38	
32	44	
33	47	
34	52	
35	23/3"	11:15
	28/6"	restrike 10/14/78



Dynamic measurements NO

Sequence No.	Depth ft

□ Capacity, Kips
● Restrike
▽ Jetting depth

Notes:
8" tip dia
14" dia at butt
Pile batter at cut-off
1.7% N
2.8% E

WCC, TTC 825, Phase II, Vol III A

10 Oct '78

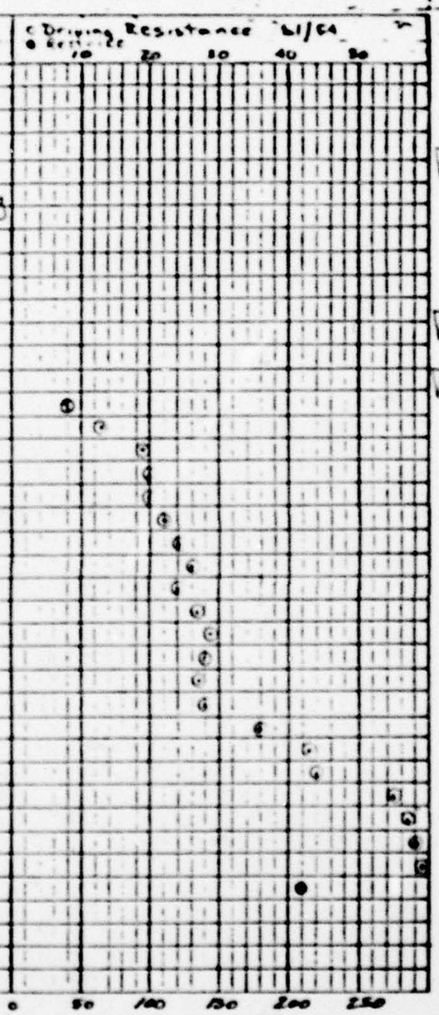
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 6200

Pile Type	Oak	Hammer	Vulcan V-1	Date	13 Oct 78
Pile length	42'	Energy	15,000	Time	1245 → 1310
Ground el.	Trench level	Operating Rate	60 bl/min	Inspector	Kisch

Depth ft	Blows	Remarks
0-1		12:45
2		
3		Pile sinks 5'
4		
5		
6		Jet to 12'; jet running
7		about 26" above tip of
8		pile.
9		
10		
11		Pile stops moving at 12', jet
12		brought up one foot and; pile
13		moves 6" towards jet
14		Jet to 14'4"
15	5	blows for 8"
16	13	
17	19	
18	20	
19	20	
20	22	
21	24	
22	26	
23	24	
24	27	
25	29	
26	28	
27	27	
28	28	
29	36	
30	43	
31	44	
32	55	
33	57	
34	58	
35	59	13:10
	21/6"	restrike 10/14/78



Dynamic measurements No

Sequence No	Depth ft
None	

□ Capacity, kips
● Restrike
▽ Jetting depth

Notes:
9" tip
13" butt
Pile batter at E.O.D.
2.9% N
0.8% E

WCC, 77C 815, Phase III
VOL III A

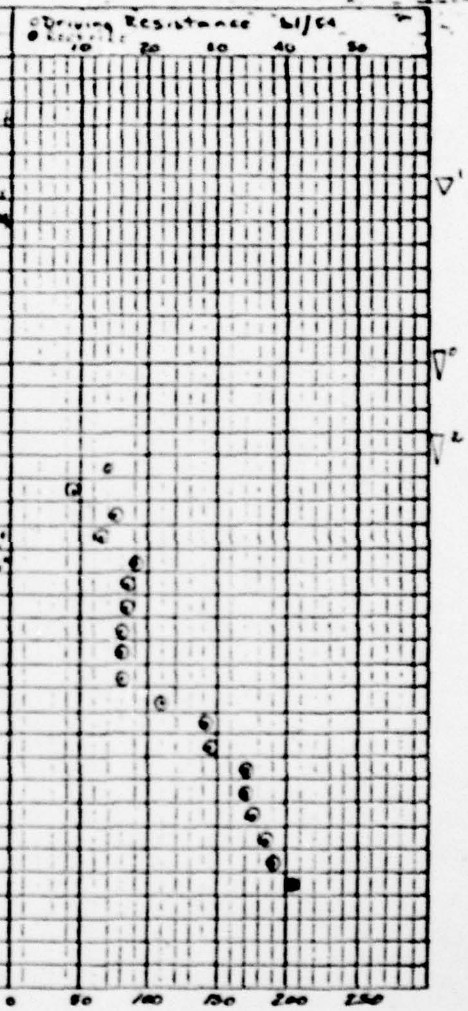
10 Oct 78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 03 01 160 1 6100

Pile Type Oak — Hammer Vulcan V-1 — Date 13 Oct 78
Pile length 42' — Energy 15,000 — Time 1410 →
Ground el. Trench Level — Operating Rate 60 b/min — Inspector - Kisch

Depth ft	Blows	Remarks
0-1		14:10
2		Pile sinks 3'
3		Jet on outside of pile, jet
4		tip at pile tip, jet to 5';
5		pile walked slightly.
6		Jet moved inside, pile comes
7		back, jet pipe not going down
8		jet to 8'
9		Jet moved to outside, pile
10		moves outside, jet to 11'
11		
12		Clay appears at 12'
13		
14		
15		Jet to 17'6"
16		
17		
18	7	blows for 6"
19	9	
20	15	
21	14	Driving stopped for 3min at 20'6"
22	18	Driving stopped for 2min at 22'6"
23	17	
24	17	14:45
25	16	
26	16	
27	16	
28	60	
29	28	
30	29	
31	34	
32	34	
33	35	
34	37	
35	38	
	31/9"	restrike 10/14/78



Dynamic Measurements NO
Sequence No — Depth ft

Notes:
Tip 12"
Pile batter at E.O.D.
3.7% N
1.8% W

□ Capacity, Kips
■ Restrike
▽ Jetting depth

WCC, 77C025, Phase IV
VOL IV A

10 Oct '78

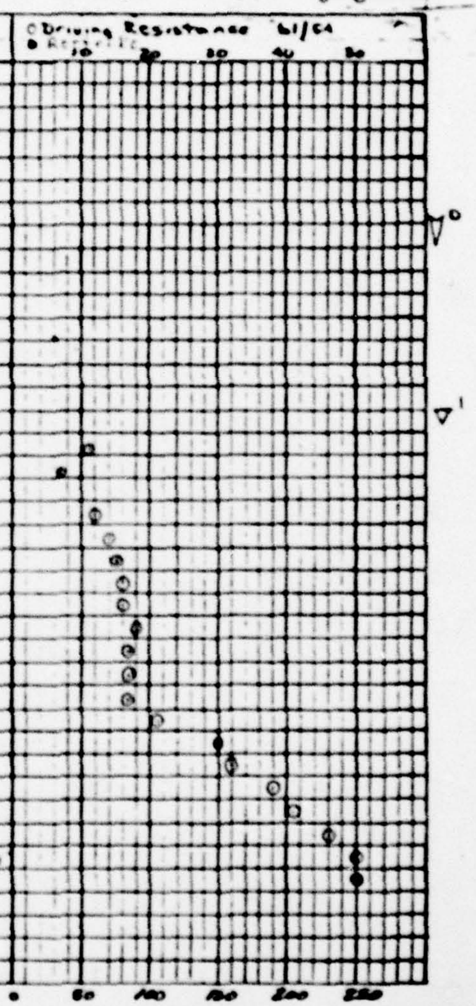
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 64 0

Pile Type	Oak	Hammer	Vulcan V1	Date	13 Oct 1978
Pile length	41.2'	Energy	15000 ft lbs	Time	20:45
Ground el.	track level	Operating Rate	60 blows/min	Inspector	Gary Locke

Depth ft	Blows	Remarks
0-1	↓	20:45
2	↓	
3	↓	
4	↓	Pre-jetted to 8'
5	↓	Pile ran to 8'
6	↓	
7	↓	
8	▼	
9	↓	
10	↓	
11	↓	Pile jetted to 16'
12	↓	
13	↓	
14	↓	
15	↓	
16	▼	
17	11	
18	7	
19	8	
20	11	
21	14	
22	15	
23	16	55 blows/min
24	16	
25	18	
26	17	
27	17	
28	17	
29	21	55 blows/min
30	30	
31	32	
32	38	
33	41	
34	46	
35	21 for 5"	driven to 34.5' by 2140
	25/6"	restrike 10/16/78



Dynamic measurements yes

Sequence No.	Depth ft
D1 (PDA)	32-34½

Notes:
Pile water at E.O.D.
2.9% N
3.4% E

□ Capacity, kips
● Restrike
▽ Jetting depth

WCC, 77C825, Phase III
Vol III A

J.G.S.L.
10 Oct 80

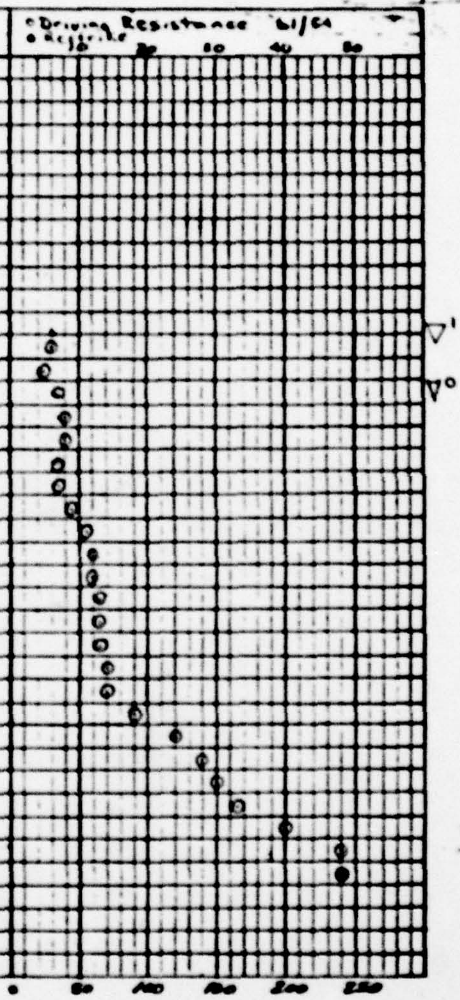
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 6500

Pile Type Oak — Hammer Vulcan V1 — Date 13 Oct. 1978
Pile length 62.0' — Energy 15000 ft lbs — Time 22:10
Ground el. Trench level — Operating Rate 60 blows/min — Inspector - Deepak Aggarwal

Depth ft	Blows	Remarks
0-1		21:10
2		
3		Pre-jetted to 16'
4		Pile ran to 6'
5		
6		
7		
8		
9		Pile jetted to 12'6"
10		
11		
12		
13	2/6"	
14	5	
15	7	
16	8	
17	8	
18	9	
19	9	
20	9	
21	11	
22	12	56 blows/min
23	12	
24	13	
25	13	
26	13	
27	14	55 blows/min
28	16	
29	18	
30	24	22:25
31	28	
32	30	
33	33	
34	40	
35	24/6"	by 22:43
	19/6"	restrike 10/14/78



Dynamic Measurements Yes

Sequence No	Depth ft
01 (PDA)	32-35'

□ Capacity, kips
● Restrike
∇ Jetting depth

Notes:
Pile batter at E.O.D.
1.7% N
1.2% E

✓ [illegible]
10Oct'78

WCC, 77C015, Phase II
Vol III A

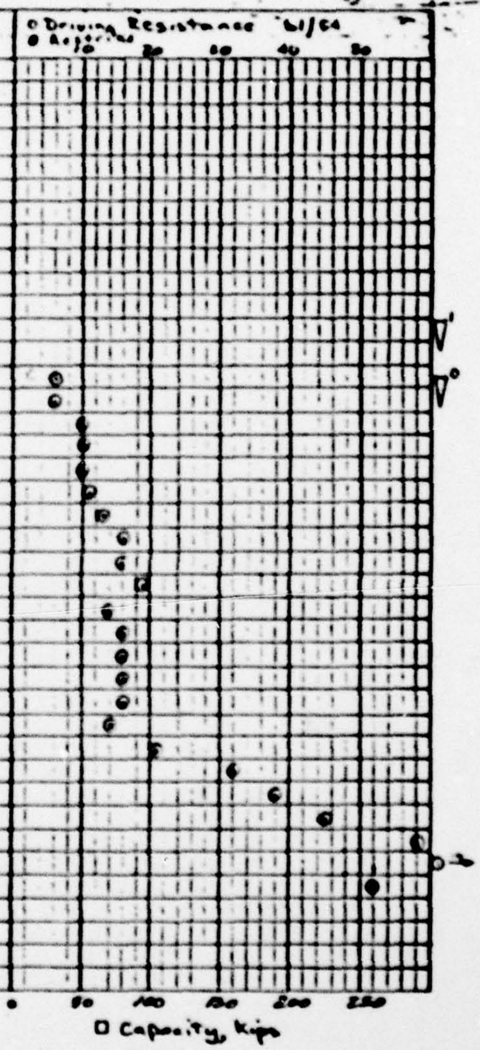
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 5600

Pile Type	Oak	Hammer	Vulcan V-1	Date	13 Oct 78
Pile length	41.9	Energy	15,000	Time	2315 → 2400
Ground el.	trench level	Operating Rate	60 bl/min	Inspector	Aggarwal

Depth ft	Blows	Remarks
0-1		23:15
2		
3		
4		Pile sinks 10½"
5		
6		
7		Clay lenses seen in
8		jetted water returns
9		
10		
11	X	
12		Jetted to 12'6"
13	3	blows for 6"
14	3	
15	6	
16	10	
17	10	
18	10	
19	11	
20	13	
21	16	
22	16	
23	19	
24	14	
25	16	
26	16	
27	16	
28	16	
29	14	
30	21	
31	32	
32	38	23:45
33	45	
34	58	
35	35	blows for 6" 24:00
	26/6"	restrike 10/14/78



Dynamic Measurements yes

Sequence No.	Depth ft
01 (PDA)	32-35

Notes:
Pile batter at E.O.D.
0.4% N
1.2% N

✓ G.S.L.
10 Oct '78

WCC, 77C 815, Phase II
Vol III A

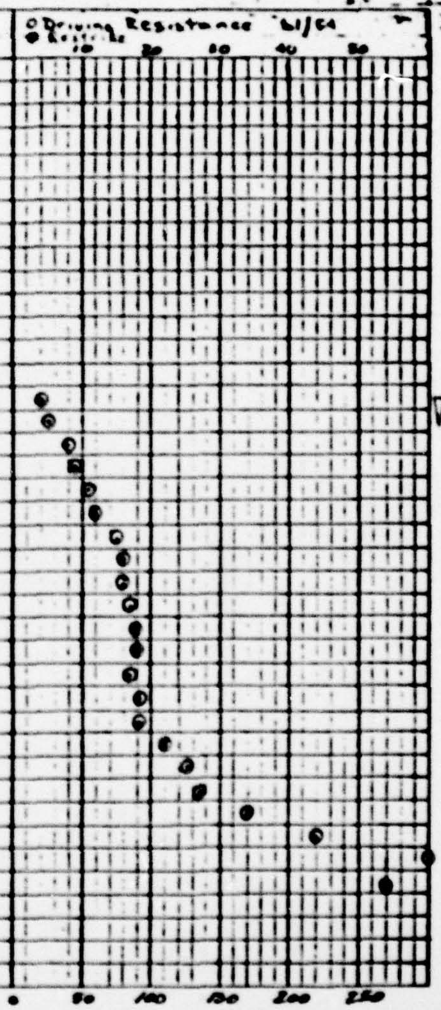
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 5700

Pile Type	Oak	Hammer	Vulcan V-1	Date	14 Oct 78
Pile length	42'	Energy	15,000	Time	0030 → 0100
Ground el.	ground level	Operating Rate	60 bl/min	Inspector -	[illegible]

Depth ft	Blows	Remarks
0-1		00:30
2		
3		
4		
5		Pile sinks 14'
6		
7		
8		
9		
10		
11		
12		
13		
14	↓	
15	4	
16	5	
17	8	
18	9	
19	11	
20	12	
21	15	
22	16	
23	16	
24	17	
25	18	
26	18	
27	17	
28	18	
29	19	
30	28	
31	25	
32	27	
33	34	
34	44	
35	80	blows for 6" 1:00
	27/6"	restrike 10/14/78



Dynamic measurements no

Sequence No Depth ft

Notes:
Pile water at E.O.D.
3.7% N
3.1% E

○ Capacity, kips
● Restrike
▽ Jetting depth

10 Oct '78

WCC, 77C815, Phase V
Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

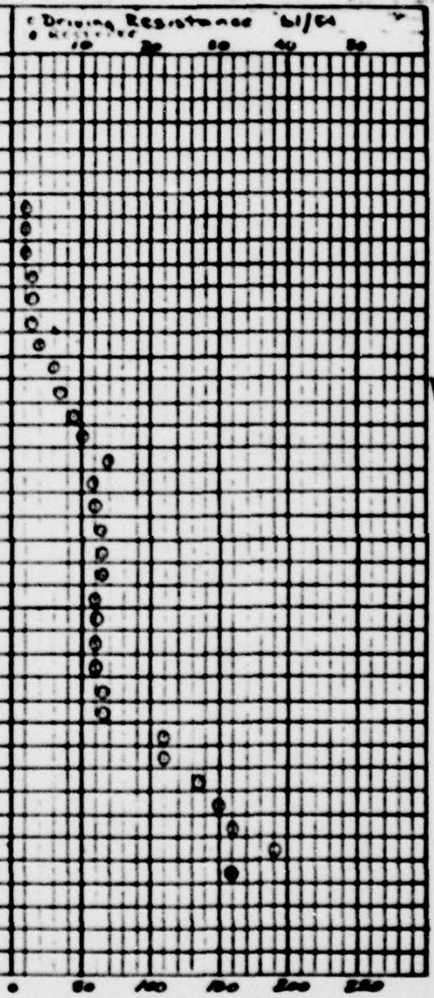
PILE DRIVING RECORD

_ of _

ID No. 03 01 160 1 6900

Pile Type	Oak	Hammer	Vulcan V1	Date	16 Oct 1978
Pile length	62'	Energy	15000 ft lbs	Time	02 15
Ground el.	Trench level	Operating Rate	60 blows/min	Inspector	D. Aggarwal

Depth ft	Blows	Remarks
0-1		2:15
2		Pre-jetted to 15'
3		Pile fell to 6'
4		
5		
6	2	
7	2	
8	2	
9	2	
10	3	
11	3	
12	3	
13	6	
14	6	
15	7	
16	9	
17	10	
18	14	
19	12	
20	12	
21	13	
22	13	
23	13	
24	12	
25	13	
26	12	
27	12	
28	13	
29	13	
30	22	
31	22	
32	27	
33	30	
34	32	
35	19/6"	
	16/6"	restrike 10/14/78



Dynamic Measurements No
Sequence No Depth ft

Notes:
Pile batter at E.O.D.
7.1% N
3.7% E

□ Capacity, kips
■ Restrike
▽ Jetting depth

WCC, 77C 825, Phase II, Vol III A

1 Mar 80

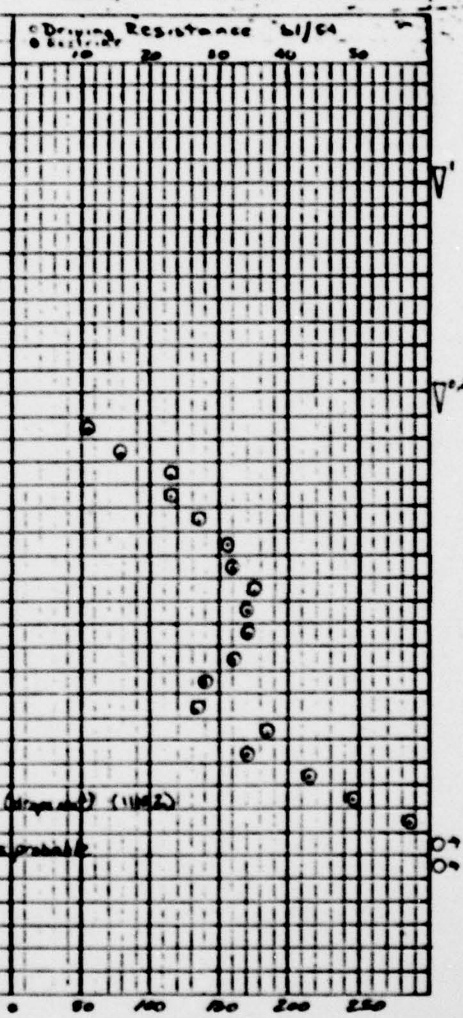
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 6000

Pile Type	Oak	Hammer	Vulcan V-1	Date	14 Oct 78
Pile length	42'	Energy	15,000	Time	1034 → 1112
Ground el.	Trench level	Operating Rate	60 bl/min	Inspector -	Hurtsimal

Depth ft	Blows	Remarks
0-1	↓	10:34
2		Pile sinks 2'6"
3	✕	
4		Jet pile to 6' pile
5		is walking E
6	✕	
7		Move jet to W side;
8		jet to 15'
9		Clay balls at 8'
10		Wood bits at 10'
11		
12		Jet and pile drop from
13		6' to 12'; Jet quickly to 15';
14		Pile walking back to proper
15	↓	position 10:48
16	11	
17	16	
18	22	
19	20	
20	27	
21	31	
22	32	
23	35	
24	34	29 bl/30 sec
25	34	
26	32	
27	68	
28	27	
29	37	
30	33	30 bl/30 sec
31	43	
32	49	Hammer malfunction at 31'6" [illegible] (1102)
33	57	Operating poorly to 35'
34	110	(79 blows for 6") low energy probable
35	79	blows for 6" to 34'6"
		11:12



Dynamic measurements: No

Sequence No	Depth ft

Notes:
Pile batter at E.O.D.
6.8% S
1.5% E

□ Capacity, kips
● Restrike
▽ Jetting depth

✓ [illegible]
10 Oct '78

WCC, 77C835, Phase II
Vol III A

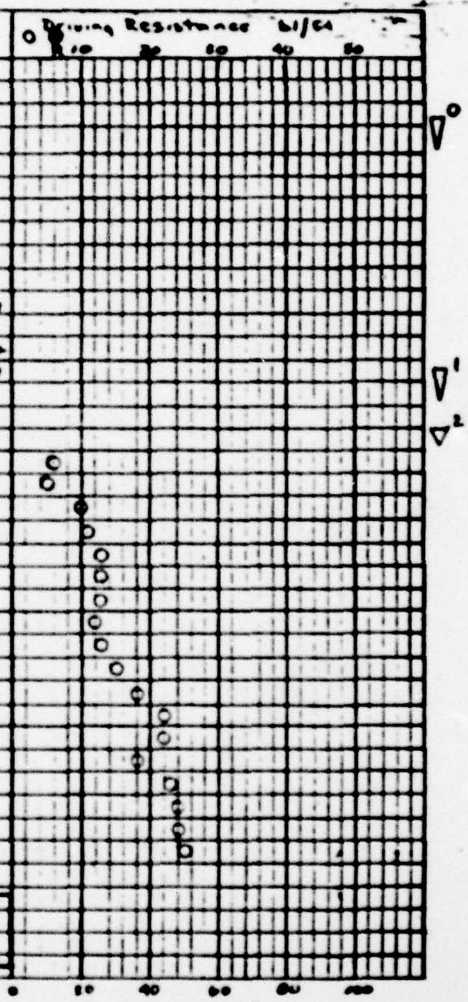
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 5100

Pile Type: Oak — Hammer: Vulcan V-1 — Date: 14 Oct. 1978
Pile length: 42.1' — Energy: 15,000 — Time: 13:12 – 13:45
Ground el.: trench level — Operating Rate: 60 bl/min — Inspector: Scott H, DAH

Depth ft	Blows	Remarks
0-1		
2		pre-jetted
3		
4		
5	2	w/o jet
6		
7		
8		
9		
10		
11	jetted	jet on SW. 4° walking
12		move jet to SE side
13		jetted to 17 ft w/ jet
14		@ 15 ft. Pile walked
15		back ~3°
16		
17		13:24
18	6	13:27
19	5	
20	10	
21	11	
22	13	
23	13	
24	13	
25	12	
26	18	
27	15	
28	18	
29	22	
30	22	
31	18	13:31
32	23	
33	24	
34	24	
35	25	13:45
	2½" N, 1° W by eye from	
	intended position @ pile butt.	



Dynamic measurements: yes

Sequence No.	Depth ft
01 (PDA)	32-35

Notes:
Pile batter at E.O.D.
1.2% S
0.2% N

□ Capacity, kips
■ Restrike
∇ Jetting depth

WCC, 77C825, Phase II
Vol. II A

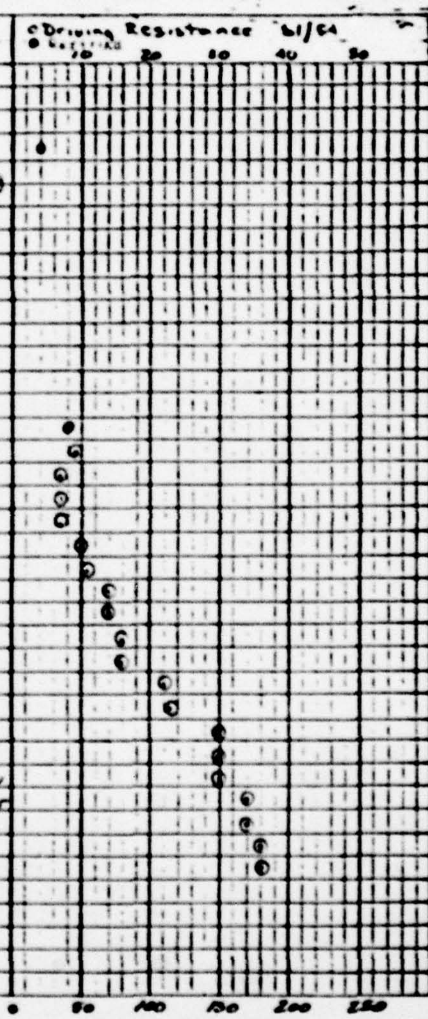
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 5900

Pile Type	Oak	Hammer	Vulcan V-1	Date	14 Oct 78
Pile length	42.2'	Energy	15,000	Time	1432 → 1537
Ground el.	trench level	Operating rate	60 bl/min	Inspector	[illegible]

Depth ft	Blows	Remarks
0-1		1432
2		Pile sinks 3'
3		
4		Drive to 4'
5		Jet to 8'; pile walking
6		4" to 5" to SW
7		Clay balls at 7'
8		
9		Jet pipe on SE side
10		Jet pile to 15'5"
11		
12		Wood bits at 12'
13		
14		
15		
16	4	blows for 6" 14:45
17	9	
18	8	
19	8	
20	8	
21	10	
22	11	
23	14	
24	14	
25	16	
26	16	28 bl/30 sec.
27	22	
28	23	
29	30	
30	30	
31	30	45 min stop for crew
32	34	break; attach analyser
33	34	
34	36	
35	36	15:37



Dynamic measurements yes

Sequence No	Depth ft
01 (PDA)	32-35

Notes:
Pile batter at E.O.D.
0.7% S
6.6% W

□ Capacity, kips
● Restrike
▽ Jetting depth

WCC, 77C 815, Phase V
Vol III A

[illegible]
10 Oct 78

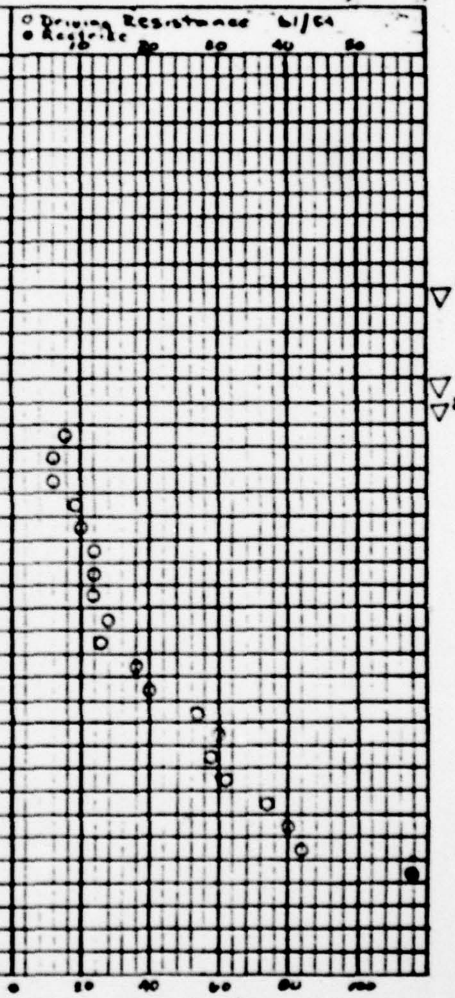
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03A01 160 1 5000

Pile Type	Oak	Hammer	Vulcan V-1	Date	14 Oct. 1978
Pile length	42.1'	Energy	15000 ft-lb	Time	17:30~18:25
Ground el.	trench level	Operating Rate	60 bl/min	Inspector	Deepak Agarwal

Depth ft	Blows	Remarks
0-1		17:30
2		
3		
4		
5		
6		① pre-jetted to 15'
7		② pile runs in to 11'
8		③ clay lenses in wash
9		
10		
11		
12		
13		③ jetted
14		
15		
16		18:08
17	8	
18	6	
19	6	
20	9	
21	10	
22	12	
23	12	
24	12	57 B/min
25	14	
26	13	
27	18	
28	20	59 B/min
29	27	
30	30	
31	29	
32	31	
33	37	
34	40	
35	21/6"	18:25
"	29/6"	restrike 10/16/78



Dynamic measurements YES

Sequence No	Depth ft
01 (PDA)	31-35
02 (restrike)	34½-35

Notes:
Pile batter at E.O.D
7.3% N
1.1% W

□ Capacity kips
● Restrike
▽ Jetting depth

✓ G.G.J.
10 Oct '78

WCC, 77C815, Phase V
Vol III A

L-12

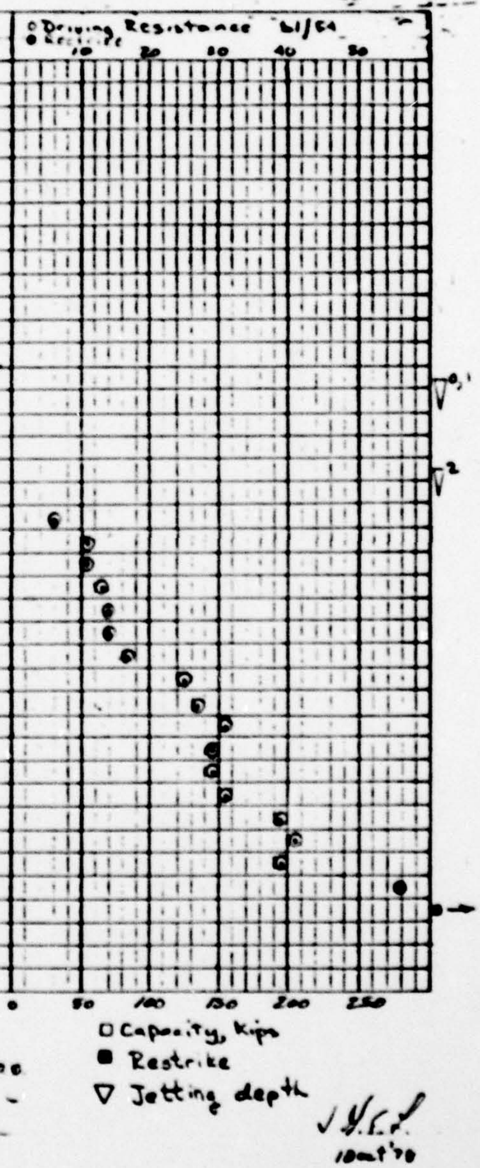
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 5800

Pile Type	Douglas Fir	Hammer	Vulcan V-1	Date	14 Oct 78
Pile length	42'7"	Energy	15,000	Time	1900 → 1925
Ground el.	trench level	Operating Rate	60 bl/min	Inspector -	Aggarwal

Depth ft	Blows	Remarks
0-1		19:00
2		
3		
4		Pile sinks 10'8"
5		
6		Organic matter seen in
7		return water
8		
9		
10		
11		
12		Jetted to 15', move
13		jet pipe to other side.
14		
15		
16		
17		Jetted to 19'
18		
19		
20	6	
21	11	
22	11	
23	13	
24	14	
25	14	
26	17	
27	25	
28	29	
29	31	
30	29	
31	29	
32	31	
33	29	61 blows/min
34	41	
35	39	19:25
	29/6"	restrike 10/18/78
	76/6"	restrike 10/20/78



Dynamic measurements NO

Sequence No.	Depth ft

Notes:
Pile bottom at 5.00
1.8% N -
0.5% E -

J.G.C.L.
10 Oct 78

WCC, 77C825, Phase II
Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

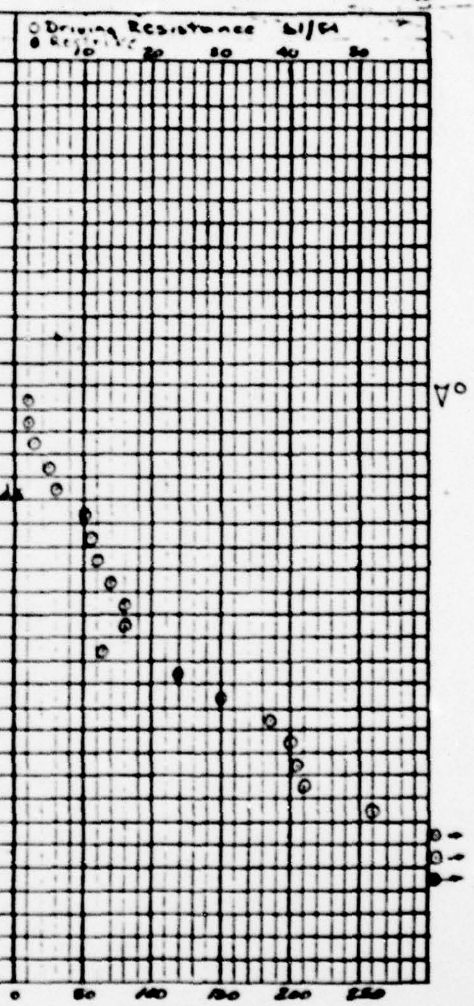
ID No. 03 01 160 1 66u0

Pile Type Oak — Hammer Vulcan V1 — Date 14 Oct 1978

Pile length 62' — Energy 15000 ft lbs — Time 20.00

Ground el. Trench level — Operating Rate 60 blows/min — Inspector - Deepak Aggarwal

Depth ft	Blows	Remarks
0-1		20:00
2		
3		
4		
5		Pre-jetted to 15'
6		Pile ran to 15'6"
7		
8		Organic matter (gravel sized pieces of lignite) in wash
9		
10		
11		
12		
13		
14		
15	1/6"	
16	2	
17	3	
18	5	
19	6	stopped to adjust leads
20	10	
21	11	
22	12	
23	14	56 blows/min
24	16	
25	18	
26	13	
27	24	59 blows/min
28	30	
29	37	Hammer double striking from 27' to 35'
30	40	
31	41	
32	42	
33	52	
34	64	
35	94 for 10"	20:30
	37/6"	restrike 10/16/78



Dynamic Measurements No

Sequence No — Depth ft

Notes:
Pile batter at E.O.D
0.6% N
2.6% E

□ Capacity, kips
● Restrike
▽ Jetting depth

WCC, YTCBIS, Phase II
Vol III A

✓ S.C.L.
10 Oct '78

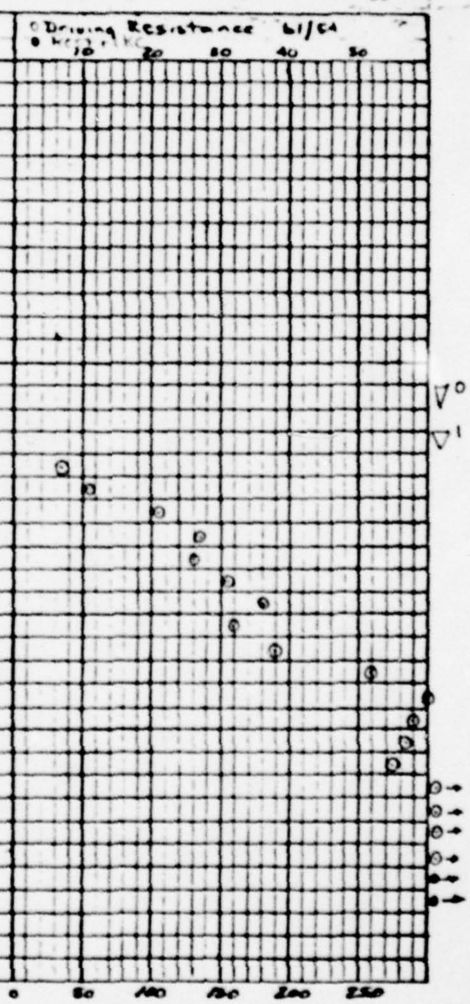
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 6700

Pile Type	Fir	Hammer	Vulcan V1	Date	16 Oct 1978
Pile length	~43'	Energy	15000 ft lbs	Time	21:45
Ground el.	Trench level	Operating Rate	60 blows/min	Inspector	D. Aggarwal

Depth ft	Blows	Remarks
0-1		21:45
2		
3		
4		Pre-jetted to 15'
5		Pile ran to 11'6"
6		
7		Organic matter (gravel
8		sized pieces of lignite)
9		in wash, 13' → 15'
10		
11		
12		
13		
14		
15		Pile jetted to 17'
16		
17		
18	7	
19	11	
20	21	
21	27	
22	26	
23	31	52 blows/min
24	36	
25	32	
26	38	
27	52	
28	60	
29	58	
30	57	
31	55	
32	67	
33	87	
34	100	hammer malfunctioning
35	62/6"	22:25
	45/6"	restrike 10/18/78
	74/6"	restrike 10/20/78



Dynamic measurements yes

Sequence No	Depth ft
01 (PDA)	30-35½'

Notes:
Pile batter at C.O.R.
2.0 % N
1.2 % E

□ Capacity, kips
● Restrike
∇ Jetting depth

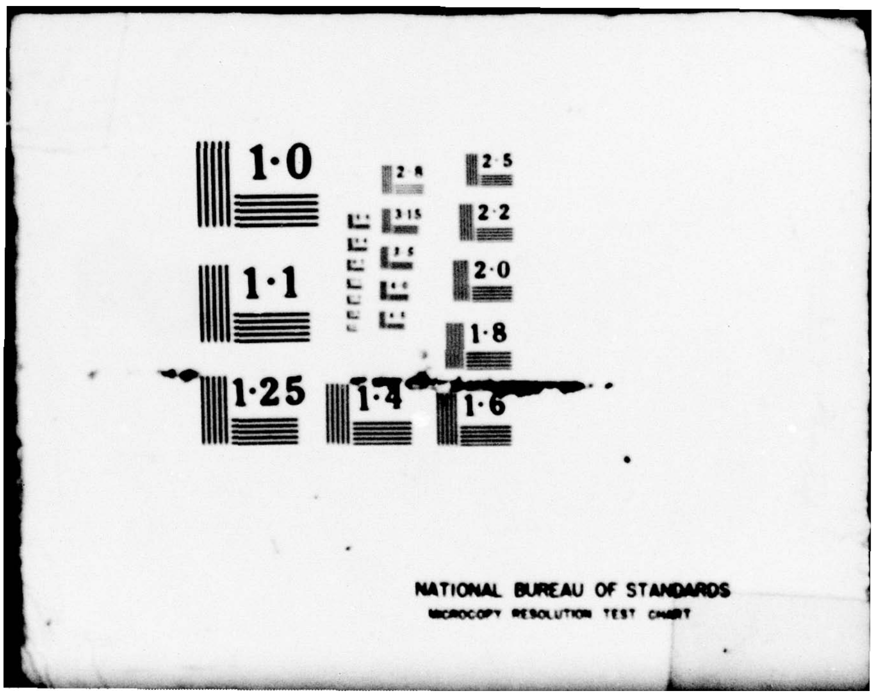
WCC, 77C815, Phase II
Vol III A

10 Oct '78

AD-A076 094 WOODWARD-CLYDE CONSULTANTS CHICAGO IL F/G 13/2
RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM--ETC(U)
JUL 79 J PEREZ , D M HOLLOWAY DACW43-78-C-0005

UNCLASSIFIED NL

3 OF 6
AD-
A076094

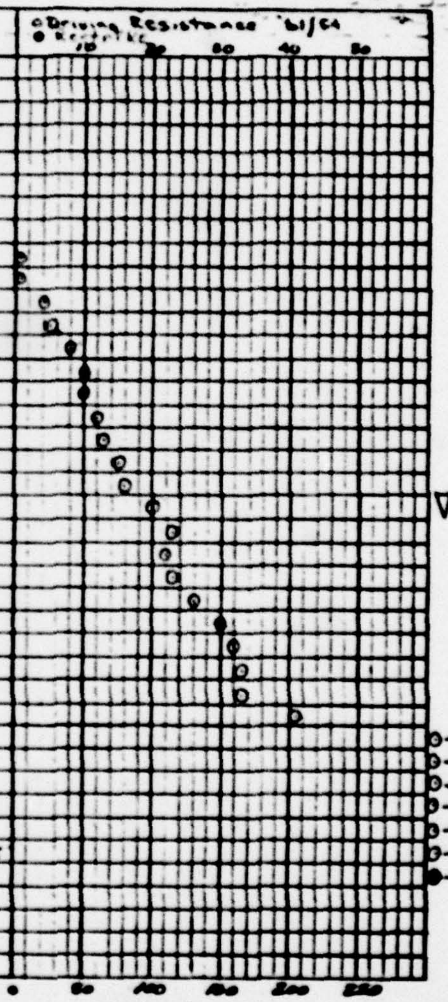

1·0
1·1
1·25
1·4
1·6
1·8
2·0
2·2
2·5
NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 03 01 160 1 6800

Pile Type	Oak	Hammer	Vulcan VI	Date	16 Oct 1978
Pile length	62'	Energy	15000 ft lbs	Time	23:25
Ground el.	Trench level	Operating Rate	60 blows/min	Inspector	D. Aguirre

Depth ft	Blows	Remarks
0-1		23:25
2		
3		Pre-jetted to 20'
4		Pile run to 8'
5		
6		
7		
8		
9	1	
10	1	
11	4	
12	5	
13	8	
14	10	
15	10	
16	12	
17	13	
18	15	
19	16	
20	20	
21	23	
22	22	
23	23	
24	26	
25	30	
26	32	
27	33	61 blows/min
28	33	
29	61	
30	71	61 blows/min
31	80	
32	91	
33	110	Hammer malfunctioning
34	112	"
35	125	" 00:35
36	[illegible]	Restrike, hammer double
		striking 10/18/78



Dynamic Measurements No
Sequence No. Depth ft

□ Capacity, kips
● Restrike
▽ Jetting depth

Notes:
Pile batter at E.O.D.
2.5% N
1.4% E

WCC, VTC 825, Phase III
Vol II A

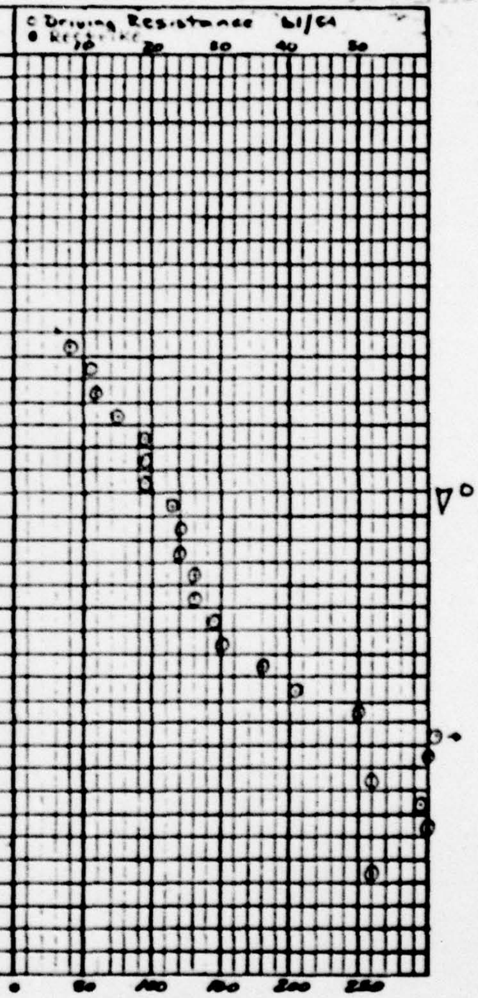
10 Oct 78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

I.D. No. 03 01 160 1 7000

Pile Type: Oak — Hammer: Vulcan V1 — Date: 17 Oct 1978
Pile length: 62' — Energy: 15000 ft lbs — Time: 02:00
Ground el.: Trench level — Operating Rate: 60 blows/min — Inspector: D. Aggarwal

Depth ft	Blows	Remarks
0-1	↓	2:00
2		
3		
4		Pre-jetted to 20'
5		Pile run to 12'
6		
7		
8		
9		
10		
11		
12	↓	
13	8	
14	11	
15	12	
16	15	
17	19	
18	19	
19	19	
20	23	
21	24	
22	24	59 blows/min
23	26	
24	26	
25	29	
26	30	
27	36	
28	41	59 blows/min
29	50	
30	71	Hammer malfunctioning
31	60	
32	52	
33	59	
34	60	
35	52	2:35



□ Capacity, kips
■ Restrike
▽ Jetting depth

Dynamic measurements: Yes

Sequence No.	Depth ft
01 (PDA)	30-35

Notes:
Pile batter at E.O.D.
2.3% N
3.9% E

WCC, 77C835, Phase III
Vol III A

[signature] 10 Oct 78

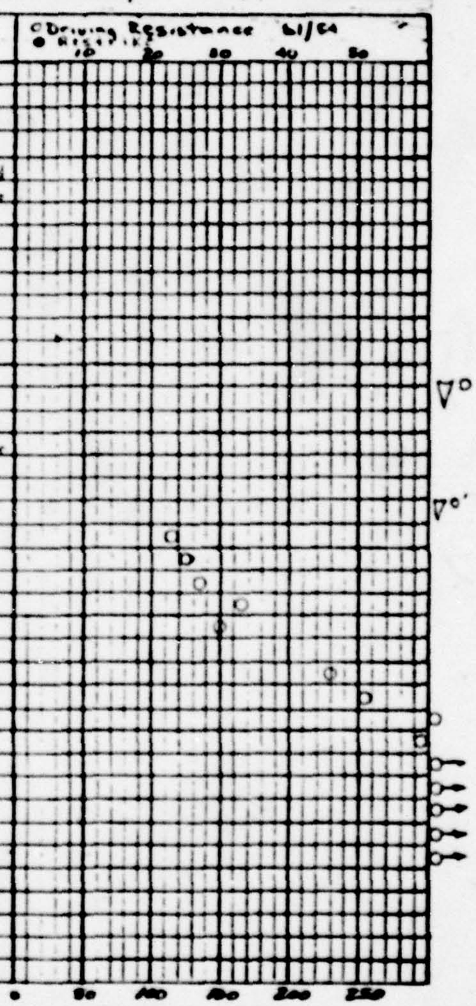
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 7100

Pile Type Oak Hammer Vulcan V1 Date 17 Oct 1978
Pile length 62' Energy 15000 ft lbs Time 08.20-09:25
Ground el. Trench level Operating Rate 60 blows/min Inspector - D.T. TSO

Depth ft	Blows	Remarks
0-1		
2		
3		Pre-jetted to 15'
4		Pile run to 8'6"
5		Pulled pile out and
6		started over due to
7		poor alignment
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		Pre-jetted to 20' for
18		the 2nd try.
19		
20		
21	23	
22	25	57 Bl/min
23	27	
24	33	
25	30	
26	missed	blow counts
27	46	
28	51	57 Bl/min
29	61	
30	59	57 Bl/min
31	66	52 Bl/min
32	69	
33	81	
34	86	62 Bl/min
35	70/11"	



Dynamic measurements No
Sequence No Depth ft

O Capacity, kips
● Restrike
▽ Jetting depth

Notes:
Pile batter at c.o.d.
1.2% S
2.2% W

WCC, YTCBIS, Phase II
Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

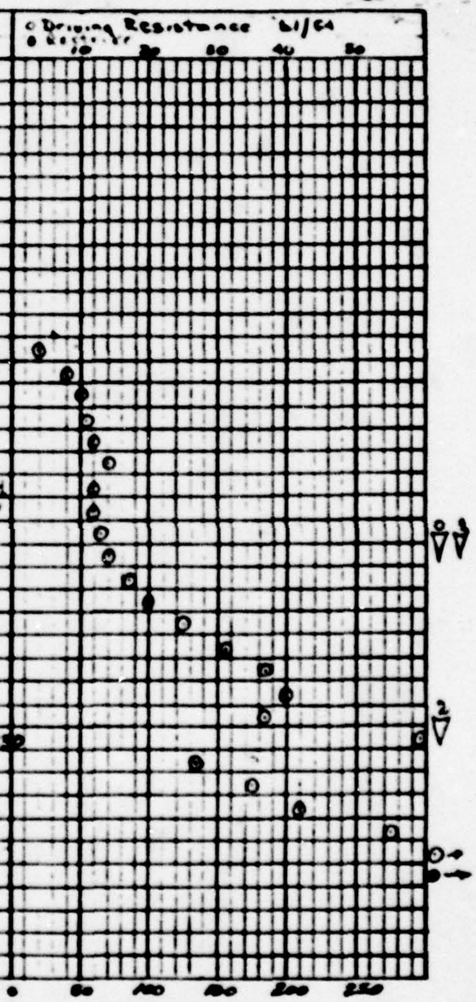
ID No. 03 01 160 1 72 0

Pile Type Oak
Pile length 42.25'
Ground el. Trench level

Hammer Vulcan V1
Energy 15000 ft lbs
Operating Rate 60 blows min

Date 18 Oct 1978
Time 00:10
Inspector - D. Aggarwal

Depth ft	Blows	Remarks
0-1		00:10
2		
3		
4		Pre-jetted to 22'
5		Pile swata 12'6"
6		
7		Organic matter (gravel
8		sized piece of lignite)
9		in wash
10		
11		
12		
13	2 for 6"	
14	8	
15	10	
16	11	
17	12	
18	14	
19	12	jetted with jet pipe on south
20	12	side of pile. Set pipe to 22'
21	13	
22	16	
23	17	
24	20	
25	25	
26	31	
27	37	
28	40	
29	37	
30	52	Jetted, set pipe to 30 ft. 00:30
31	27	
32	35	
33	42	
34	55	
35	62	01:03
	52/6"	restrike 10/21/78



Dynamic measurements Yes

Sequence No.	Depth ft
01 (PDA)	20-35'

Notes:
Pile batter at E.O.D
2.7% S
0.4% E

□ Capacity, kips
● Restrike
▽ Jetting depth

✓ G.E.L.
10 Oct 79

WCC, 77C825, Phase II
Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

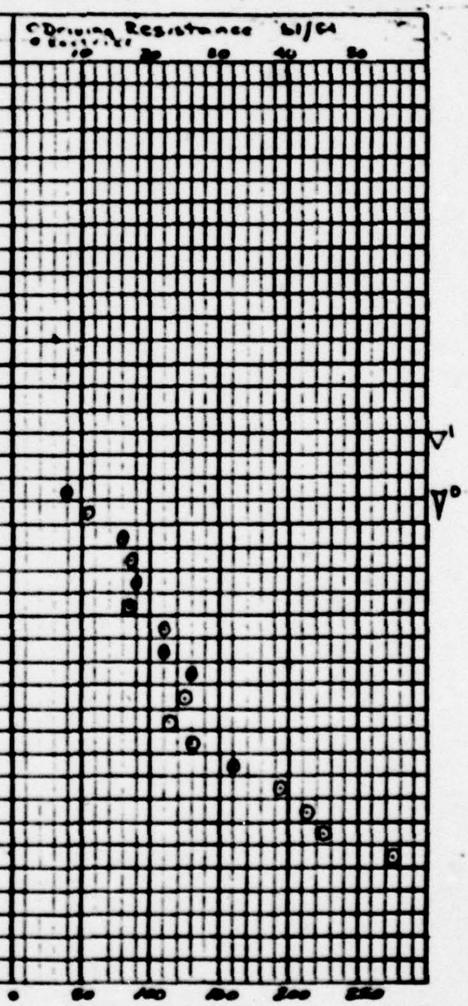
ID No. 03 01 160 1 7300

Pile Type Oak
Pile length 42'
Ground el. Trench level

Hammer Vulcan V1
Energy 15000 ft lbs
Operating Rate 60 blows/min

Date 18 Oct 1978
Time 07:45-8:45
Inspector - D.T. T'SO

Depth ft	Blows	Remarks
0-1		7.00
2		Pre-jetted to 20ft.
3		Pile run to 7ft
4		
5		
6		
7		
8		
9		Pile jetted to 17'6", with
10		jet on south-east side.
11		
12		
13		
14		
15		
16		
17		
18		Pile jetted to 18', with jet on
19	8	north east side
20	11	
21	16	
22	17	
23	18	
24	17	
25	22	55 blows/min
26	22	
27	26	56 blows/min
28	25	
29	23	
30	26	56 blows/min
31	32	
32	39	58 blows/min
33	43	
34	45	
35	55	59 blows/min 8:25



□ Capacity, kips
■ Restrike
▽ Jetting depth

Dynamic measurements No

Sequence No.	Depth ft

Notes:
Pile batter at C.O.W.
0.4% S
7.7% E

WCC, 77C815, Phase III
Vol III A

H.S.
10 Oct '78

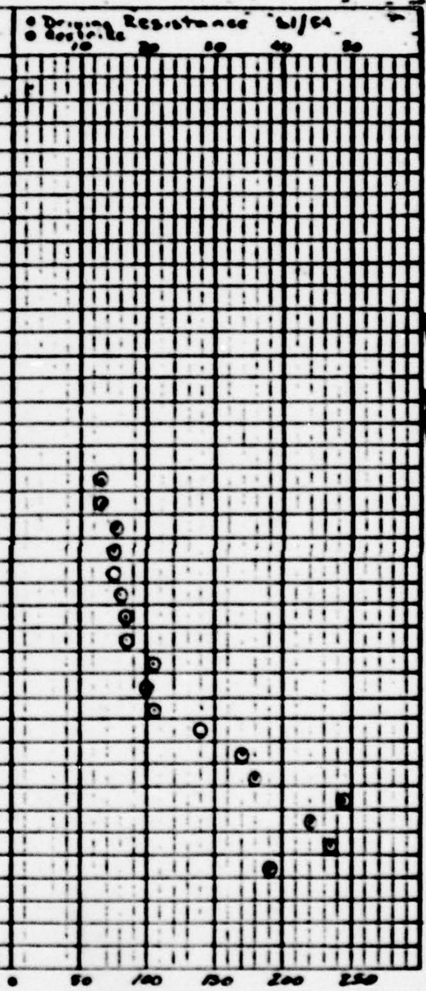
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 7700

Pile Type OAK   Hammer Vulcan V-1   Date 18 Oct 78
Pile length 42'   Energy 15,000   Time 0856 → 0925
Ground el. Trench Level   Operating Rate 60 bl/min   Inspector TSO

Depth ft	Blows	Remarks
0-1	↓	8:56
2		Pile sinks 4'
3		
4	X	
5		
6		Jet to 12'6" with jet
7		on SE side
8		
9		
10		
11		
12		
13	X	
14		Jet to 17' with jet
15		on NE side
16		
17	↓	
18		
19	13	
20	13	
21	15	
22	15	
23	15	58 bl/min
24	16	
25	17	
26	17	
27	21	
28	20	
29	21	
30	28	
31	34	57 bl/min
32	36	
33	49	Hammer double bumping
34	94	
35	47	
	8/25	9:25



□ Capacity, Kips
■ Restrike
▽ Jetting depth

Dynamic measurements NO
Sequence No   Depth ft

Notes: Pile Batter at E.O.D.
0.4% N
1.2% E

WCC, VTC BIS, Phase II
VTC 13A

✓ H.S.T.
10 Oct 78

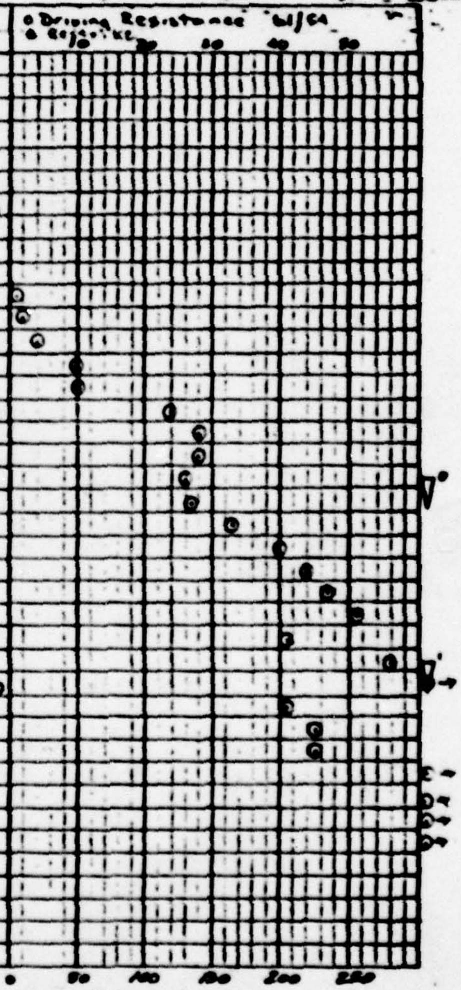
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 7400

Pile Type: Oak   Hammer: Vulcan V-1   Date: 18 Oct 78
Pile length: 42'6"   Energy: 15,000   Time: 1800 → 1855
Ground el.: Trench level   Operating Rate: 60 bl/min   Inspector: Aggarwal

Depth ft	Blows	Remarks
0-1	↓	18:00
2		Pile sink 12'; pile
3		removed because of
4		incorrect positioning;
5		pile sinks 10'.
6		
7		Organic matter in wash
8		at 30'
9		
10	↓	
11	1	
12	2	
13	4	
14	10	
15	10	
16	24	stopped after 16 blows
17	28	
18	28	
19	26	
20	27	
21	32	61 bl/min
22	40	
23	44	
24	47	
25	51	
26	41	63 bl/min
27	56	
28	90	stopped driving at 1840
29	41	Jet to 28' with jet on
30	45	S side
31	45	
32	71	69 bl/min
33	88	
34	78	
35	80	18:55



Dynamic measurements: NO

Sequence No. | Depth ft

Notes:
Pile curved significantly between 3' and 9' from bottom of pile

1.3% S
0.3% W
Pile batter at E.O.D.

WCC, 77C 025, Phase V
Vol III A

10 Mar '78

L-92

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 03 01 160 1 7530

Pile Type	OAK	Hammer	Vulcan V-1	Date	18 Oct 78
Pile length	43'	Energy	15,000	Time	1940 → 2105
Ground el.	Trench Level	Operating Rate	60 bl/min	Inspector	Aggarwal

Depth ft	Blows	Remarks	○ Driving Resistance bl/ft ● Restrike
0-1	↓	During pre-jetting, organic	19:40
2		matter in return wash,	
3		water changes from	
4		grey to brown to grey.	
5			
6			
7		Pile sinks 9'8"; pile	
8		position 8" W	
9			
10	X		
11		Jet to 17' with jet	
12		on E side	
13			
14			
15			
16			
17	↓	20:13	
18	19		
19	23		
20	22		
21	26	59 bl/min	
22	30		
23	39	56 bl/min	
24	46		
25	50	56 bl/min	
26	44	57 bl/min	
27	58	57 bl/min	
28	72		
29	24	Jet to 26'; clay lenses;	20:20
30	40	gravel sand organic matter	20:30
31	40	in wash 21:00	
32	50		
33	72		
34	80		
35	95	21:05	

Driving resistance scale: 10, 20, 30, 40, 50
Capacity scale: 0, 50, 100, 150, 200, 250

□ Capacity, kips
● Restrike
▽ Jetting depth

Dynamic measurements yes

Sequence No	Depth ft
01 (PDA)	30-35'

Notes:
on lifting leads
surrounding sand
caves in hole
Pile batter at E.O.D.
4.1 %, N
8.8 %, W

WCC, 77C 825, Phase II
Vol III A

✓ S.S.L.
18 Oct 78

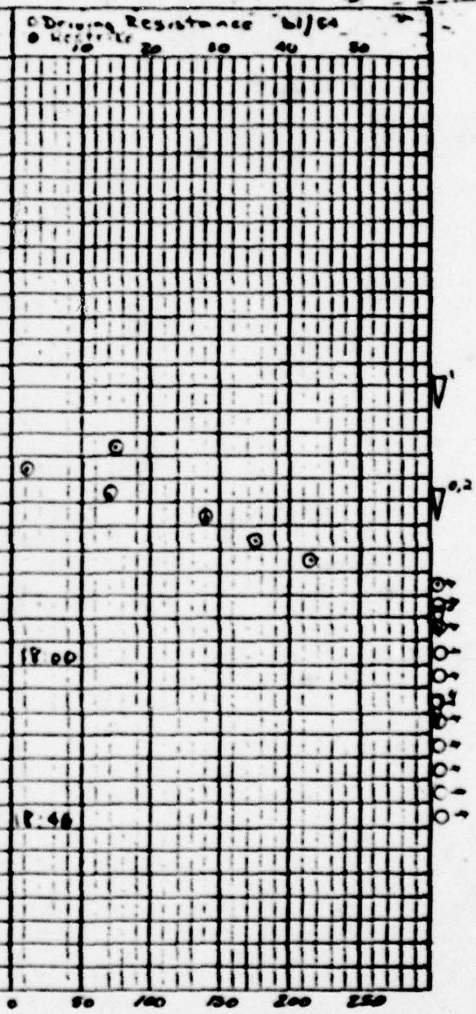
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 7300

Pile Type	OAK	Hammer	Vulcan V-1	Date	19 Oct 78
Pile length	42'4"	Energy	15,000	Time	1700 → 1846
Ground el.	Trench Level	Operating Rate	60 bl/min	Inspector -	Aggarwal

Depth ft	Blows	Remarks
0-1		17:00
2		
3		
4		Pile sinks 9'6"
5		
6		
7		
8		
9		
10		
11		Jet to 15' with jet on
12		SW and E side
13		
14		
15		17:57
16	15	Pile walking NW; jet
17		to 20'
18	2	
19	12	
20	28	
21	35	58 bl/min
22	73	
23	70	59 bl/min
24	64	
25	74	58 bl/min
26	63	Jet to 25' with jet on
27	66	S side; organic matter
28	68	in wash
29	105	Jet to 28'6" with jet
30	90	on SE side.
31	85	
32	86	
33	115	Driving stopped at 33' in
34		order to avoid damage to
35		nearby 3-D gage



Dynamic measurements - yes

Sequence No	Depth ft
01 (PDA)	29-33'

Notes:
Pile batter at E.O.D.
0.3% S
1.8% E

□ Capacity, kips
■ Restrike
▽ Jetting depth

✓ [signature]
10 Oct '78

WCC, 77C 835, Phase II
Vol III A

2

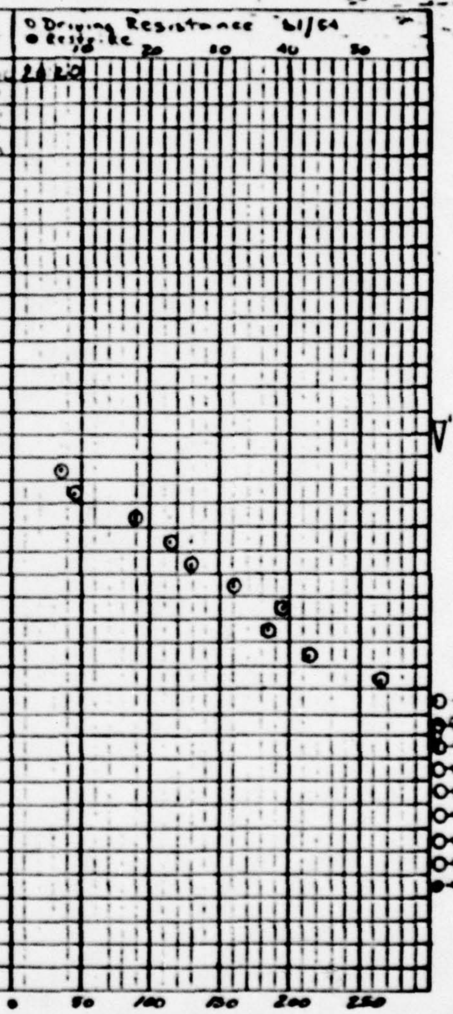
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 7800

Pile Type	OAK	Hammer	Vulcan V-1	Date	19 Oct 78
Pile length	42'5"	Energy	15,000	Time	1925 → 2105
Ground el.	Trench level	Operating rate	60 bl/min	Inspector -	Aggarwal

Depth ft	Blows	Remarks
0-1		During prejetting, organic
2		matter in return water at 6'
3		depth; gravel at 22'-24'.
4		Clay lenses in return wash
5		
6		Pile sinks 8'
7		
8		20:33
9		
10		
11		
12		Jet to 17'
13		
14		
15		
16		
17		20:40
18	7	20:43
19	9	
20	18	
21	23	
22	26	
23	32	57 bl/min
24	39	
25	37	
26	43	
27	53	
28	69	
29	75	
30	64	
31	70	
32	76	
33	96	
34	104	
35	120	21:03
	38/6"	restrike 10/21/78



Dynamic measurements No

Sequence No — Depth ft

Pile Notes: tilt at c.o.
1.1% N
0.2% W

□ Capacity, Kips
■ Restrike
▽ Jetting depth

✓ H.S.L.
10 Oct '79

WCC, 77C825, Phase II
Vol IIIA

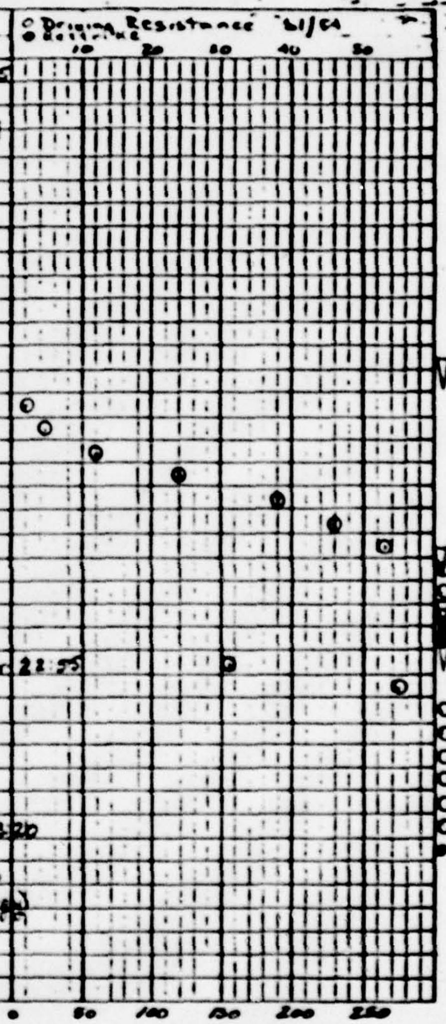
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 7900

Pile Type: Oak Hammer: Vulcan V-1 Date: 19 Oct 78
Pile length: 41'11" Energy: 15,000 Time: 2215 → 2320
Ground el. Trench bed Operating Rate: 60 bl/min Inspector: Aggarwal

Depth ft	Blows	Remarks
0-1		During prejetting 22:15
2		organic matter in
3		return wash at 10'; clay
4		lenses at 12'; more
5		organic matter at 24'
6		to 26'.
7		
8		Pile sinks 9'
9		
10		
11		Jet to 14'
12		
13		
14		
15	2	22:45
16	5	
17	12	
18	24	55 bl/min
19	38	
20	46	
21	53	56 bl/min
22	62	
23	62	
24	66	
25	76	
26	91	Jet to 22'; organic matter 22:55
27	55	in return wash
28	75	
29	95	
30	125	Jet to 24'6"; organic
31	94	matter in return wash
32	175	Jet to 26'
33	154	Stop driving at 33' 23:20
34	20/1"	restrike 10/21/78
35		pile has bend @ top
		(absorbing a lot of energy)



Dynamic measurements No
Sequence No Depth ft

Notes:
Pile batter at E.O.D.
0.3% S
3.9% E

□ Capacity, kips
■ Restrike
▽ Jetting depth

[signature]
10 Oct '78

WCC, 77C825, Phase II
Vol III A

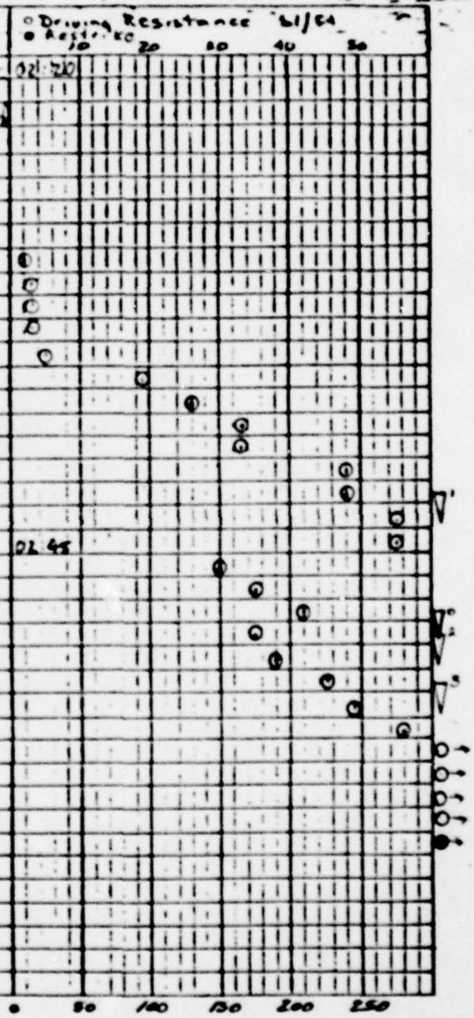
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 8100

Pile Type Oak   Hammer Vulcan V-1   Date 20 oct 78
Pile length 42' 3"   Energy 15,000   Time 0220 → 0315
Ground el. Trench Level   Operating Rate 60 bl/min   Inspector - Aggarwal

Depth ft	Blows	Remarks	○ Driving Resistance bl/ft ● Restrike
0-1	↓	During prejetting, organic	02:20
2		matter in trench; pile	
3		sinks 2½"; pile extracted	
4		because of improper	
5		positioning; reject hole	
6			
7		Pile sinks 8'	
8	↓		
9	2		
10	3		
11	3		
12	3		
13	5		
14	19		
15	26		
16	33		
17	33	Checked pile position	
18	48		
19	48		
20	55		
21	55	Jet to 20' with jet on	02:45
22	30	S side	
23	35		
24	42		
25	35		
26	38		
27	45		
28	49		
29	56		
30	121	Jet to 26' 03:00	
31	138		
32	192	Jet to 28'; organic	
33	100/6.5"	matter in water 03:15	
34	58/4"	restrike 10/21/78	
35			



Dynamic measurements No
Sequence No   Depth ft

Notes:
Pile batter at E.O.D
4.4% S
2.4% E

□ Capacity, kips
■ Restrike
▽ Jetting depth

J.H.C.L.
10 Oct '78

WCC, 77C825, Phase II
Vol II A

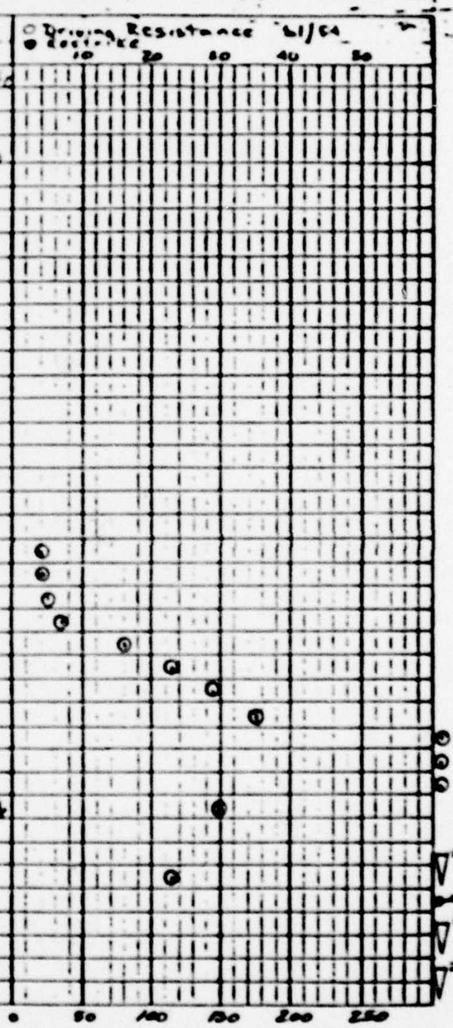
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 28
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 08 0I I60 I 8200

Pile Type	Oak	Hammer	Vulcan V-1	Date	20 Oct 78
Pile length	42'	Energy	15,000	Time	0750 → 0947
Ground el.	Trench level	Operating Rate	60 bl/min	Inspector	TSO

Depth ft	Blows	Remarks
0-1		During prejetting, lignite
2		coming up in returned
3		wash from 16' to 35';
4		wood pieces from 25' to
5		33'
6		
7		Pile sinks 14'
8		
9		
10		
11		
12		
13		
14		
15		
16		
17	14	
18		
19		
20		
21	4	
22	4	
23	5	
24	7	
25	16	
26	23	
27	29	
28	35	
29	71	
30	57/6"	
31	173/10.5"	Jet to 38' with jet on NE side
32	30	Jet to 40' with jet on W side
33		Pile walks 3" N during
34		driving
35	23	
	34/6"	restrike 10/21/78



Dynamic Measurements NO

Sequence No.	Depth ft

Notes:
Pile batter at c.o.
5.4% S
7.8% E

WCC, 77C 8IS, Phase II
Vol III A

J.G.L.
10 Oct 78

L 34

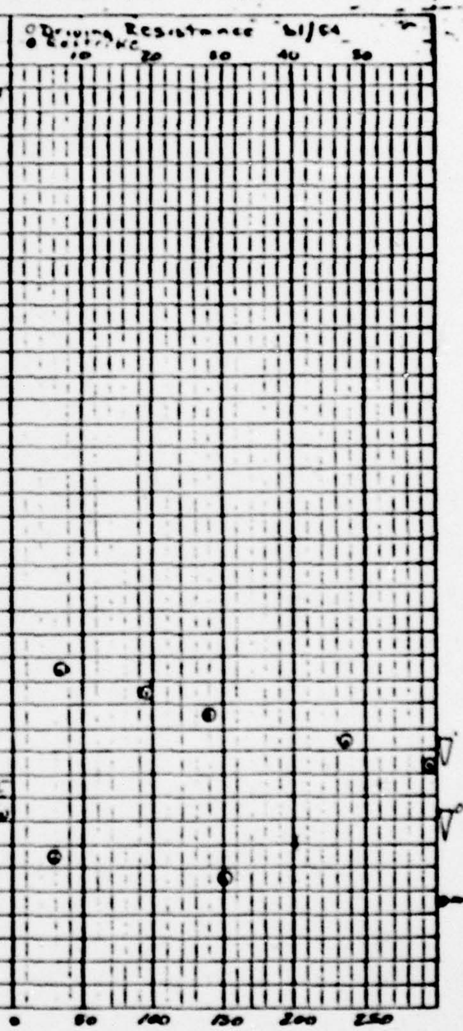
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 8300

Pile Type: Oak — Hammer: Vulcan V-1 — Date: 20 Oct 78
Pile length: 42' — Energy: 15,000 — Time: 1015 → 1150
Ground el.: Trench Level — Operating Rate: 60 bl/min — Inspector: TSO

Depth ft	Blows	Remarks
0-1		10:15 During prejetting
2		quite and mixed
3		pieces in return wash
4		from 20' to 30'; clay
5		pieces from 17' to 20'
6		
7		
8		
9		
10		
11		
12		
13		Pile sinks 25'
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26	7	
27	19	
28	28	
29	47	57 bl/min
30	69	58 bl/min 10:45
31		Jet to 30' with jet on SE
32		and NE; water time 2min
33		Pile walks 3"-4" to S
34	6	
35	30	11:50
	57/6"	restrike 10/21/78



Dynamic measurements yes

Sequence No.	Depth ft
01 (PDA)	33-34'

□ Capacity, Kips
■ Restrike
▽ Jetting depth

Notes:
1.1% N } Pile batter
6.0% E } at E.O.D.

J.H.S.L.
10 Oct 78

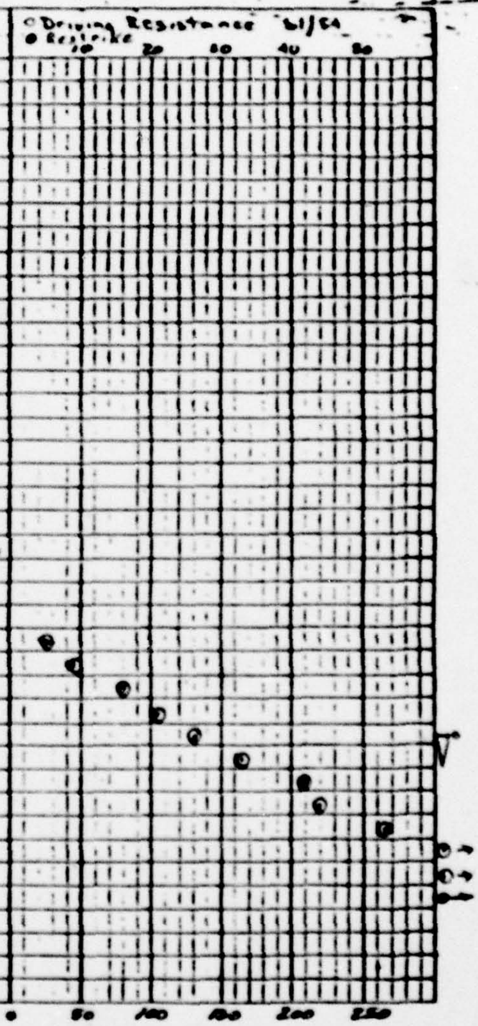
WCC, TTC 815, Phase II
Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 08 UT T60 T 84C0

Pile Type	OAK	Hammer	Vulcan V-1	Date	20 Oct 78
Pile length	42'	Energy	15,000	Time	1356→1447
Ground el.	Trench Level	Operating Rate	60 bl/min	Inspector	TSO

Depth ft	Blows	Remarks
0-1		During prejetting,
2		wood pieces and
3		lignite in returned wash
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		Pile sinks 24'
16		
17		
18		
19		
20		From 20' to 25' lignite
21		comes up with return
22		wash
23		
24	↓	
25	5	
26	9	
27	16	
28	21	
29	26	54 bl/min
30	33	
31	42	
32	49	
33	53	
34	65	
35	81	
	44/6"	restrike 10/21/78



Dynamic measurements yes

Sequence No.	Depth ft
01 (PDA)	30-35'

Notes:
0.16 Water at C.A.O.
3.1% N
2.1% E

□ Capacity, kips
● Restrike
▽ Jetting depth

WCC, 77C825, Phase IV
Vol III A

10 Oct '78

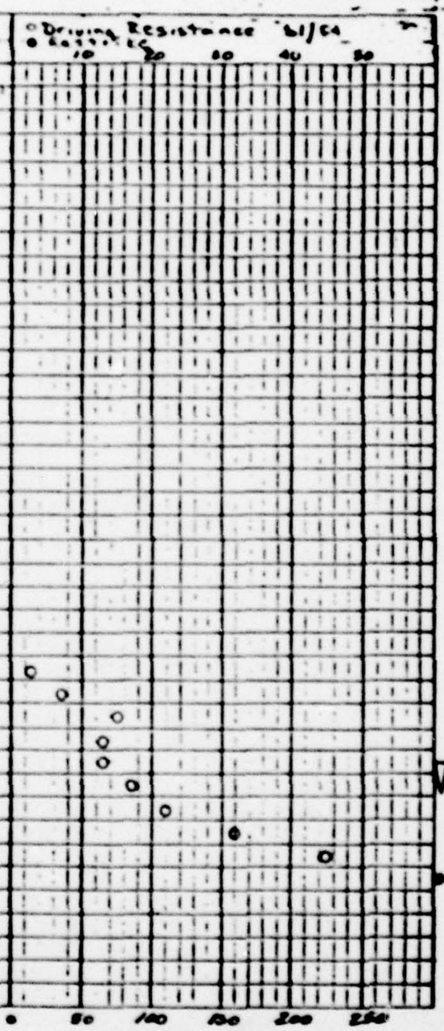
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 OT T60 T 8500

Pile Type	Oak	Hammer	Vulcan V-1	Date	20 Oct 78
Pile length	42'	Energy	15,000	Time	1600 → 1650
Ground el.	Trench Level	Operating Rate	60 bl/min	Inspector	TSO

Depth ft	Blows	Remarks
0-1	↓	1600 During pre-jetting,
2		lignite returned in
3		wash
4		
5		
6		
7		
8		Pile sinks 25'
9		
10		
11		
12		
13		
14		
15		
16		At 16' & 17' Wood pieces
17		returned in wash
18		
19		
20		At 19' to 23' lignite
21		returned in wash
22		
23		
24		
25	↓	
26	3	
27	7	
28	15	
29	13	
30	13	
31	17	1640
32	22	
33	32	58 bl/min
34	45	1650
35	29/5"	restrike 10/21/78



□ Capacity, kips
■ Restrike
▽ Jetting depth

Dynamic measurements yes

Sequence No	Depth ft
D1 (RDA)	30-34½'

Notes:
Pile batter at E.O.D.
1.6% N
1.8% E

WCC, 77C825, Phase II
Vol II A

10 Oct 78

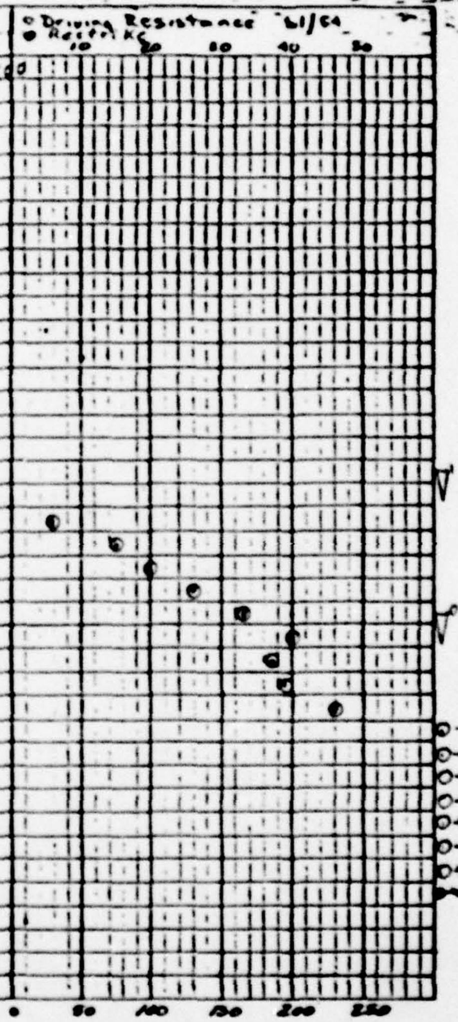
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 8000

Pile Type Oak   Hammer Vulcan V-1   Date 20 Oct 78
Pile length 42'6"   Energy 15,000   Time 2400 → 0045
Ground el. Trench level   Operating rate 60 bl/min   Inspector - Aggarwal

Depth ft	Blows	Remarks
0-1		During pre-setting 2400
2		organic matter in
3		returned wash
4		
5		Pile sinks 11'
6		
7		
8		
9		
10		
11		
12	5	
13	10	
14		
15		
16		Jet to 19'
17		
18		
19		
20	6	
21	15	
22	20	
23	26	
24	33	
25	40	
26	37	
27	39	
28	46	
29	74	
30	84	
31	110	
32	119	
33	120	
34	139	
35	141	00:45
	56/6"	restrike 10/21/78



Dynamic measurements No
Sequence No.   Depth ft

Notes:
Pile batter at C.O.O.
1.5% N
0.6% E

□ Capacity, kips
■ Restrike
▽ Jetting depth

J.M.S.L.
10 Oct '78

WCC, 77C825, Phase II
Vol III A

Y7C-825
Phase IV ; Vol III A

L.2 COMPLETE FIELD LOGS OF
INSTALLATION OF TIMBER PILES UNDER MONOLITH M1

The field logs are presented in chronological order of timber pile installation (the timber pile number corresponds to the two digits preceeding the last two zeros of the Id. No.)

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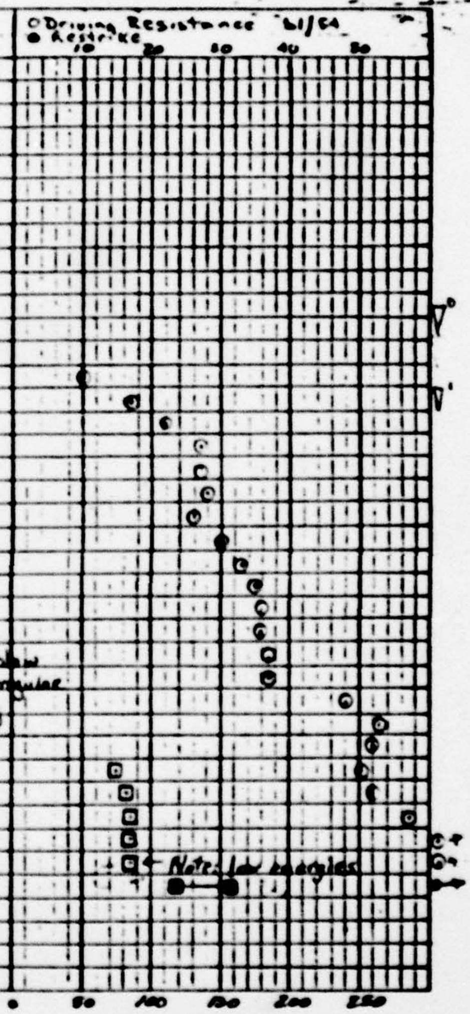
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 1200

Pile Type	Douglas Fir (I)	Hammer	Vulcan V-1	Date	16 Oct 78
Pile length	41.7"	Energy	15,000	Time	1250 → 1410
Ground el.	Trench Level	Operating Rate	60 bl/min	Inspector	TSO

Depth ft	Blows	Remarks
0-1		12 50
2		
3		
4		pile sank to 6'
5		
6		
7		
8		Jet to 12'; jet pipe on
9		S side.
10		
11		
12		Clay balk at 12'
13		
14	5/6"	
15	17	
16	22	
17	27	
18	27	
19	28	
20	26	
21	30	
22	33	
23	35	
24	36	
25	36	
26	37	Sandfroad with [illegible] on each blow
27	37	~55-60 bl/min sound irregular
28	48	Hammer malfunctioning
29	53	
30	52	
31	50	
32	52	
33	57	
34	77	63 bl/min
35	62	1410
	110/6"	restrike 10/20/78



□ Capacity, Kips
■ Restrike
▽ Jetting depth

Dynamic measurements yes

Sequence No.	Depth ft
A1 (PDA)	22-34.6'
A2 restrike (PDA)	

Notes:
Pile batter of E.O.D
1.3% N
2.8% W

WCC, VTC 826, Phase II
Vol III A

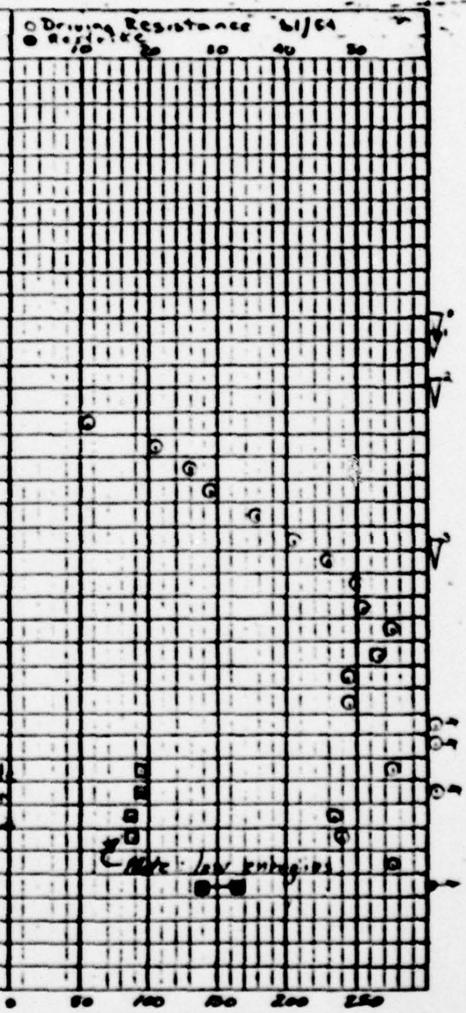
✓ [illegible]
18 Oct 78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 03 01 160 1 0400

Pile Type Douglas Fir (1) Hammer Vulcan V-1 Date 16 Oct 78
Pile length 47.1' Energy 15,000 Time 1535 → 1642
Ground el. Trench Level , Operating Rate 60 bl/min Inspector- TSO

Depth ft	Blows	Remarks
0-1		15:35
2		Jet on SE side
3		Pile sinks 3'
4		Jet to 12'6" with jet
5		on NE Side
6		
7		
8		
9		
10		
11		
12		
13		Jet to 15' with jet on
14		SE side
15		
16	11	
17	21	
18	26	
19	29	
20	36	
21	41	57 bl/min
22	46	
23	50	
24	51	
25	55	
26	53	57 bl/min
27	49	
28	49	
29	87	
30	119	16:10
31	55	Jet to 32' on NE and SE side
32	65	From 31' to 34'9", hammer
33	77	varies from 57 to 60 bpm
34	98	
35	41/9"	16:42
	26/6"	restrike 10/20/78



Dynamic measurements Yes

Sequence No	Depth ft
01 (PDA)	30'-34'9"
02 restrike (PDA)	34'9"-35'5"

Notes:
Pile batter at E.O.D.
2.7% N
0.20% E

□ Capacity, kips
● Restrike
▽ Jetting depth

WCC, 77C825, Phase II
Vol III A

10 Oct '79

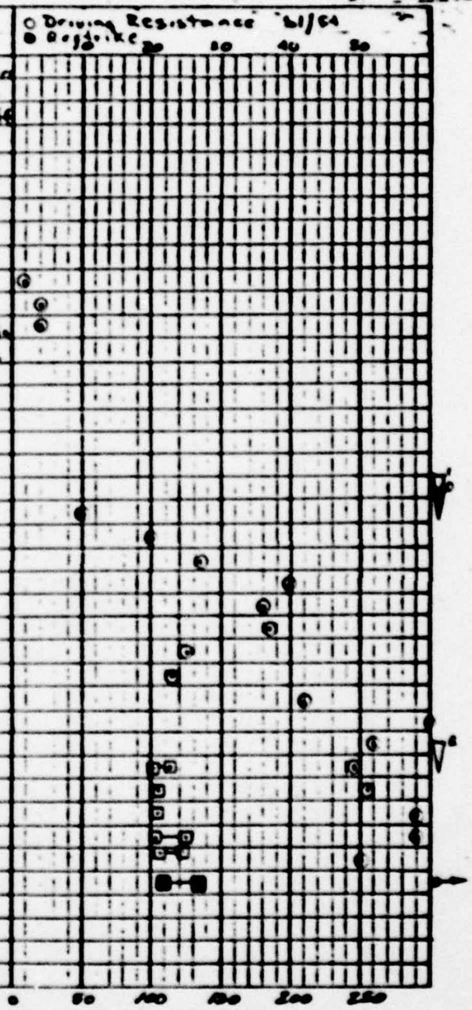
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 I 0700

Pile Type Douglas Fir (I) Hammer Vulcan V-1 Date 16 Oct 78
Pile length 42' Energy 15,000 Time 1800 → 1945
Ground el. Trench Level Operating Rate 60 bl/min Inspector - Aggarwal

Depth ft	Blows	Remarks
0-1	↓ ↓	18:00 pile sinks 8'6" and moved
2		out of position in leads; out
3		rigger pulled in; 18:25 pile off
4		location; removed pile,
5		and repositioned.
6		
7		Pile sinks 9'
8		
9		
10	2	Pile walking W
11	4	Jet to 19'6"; pile walks
12	4	2" S; 19:00; organic matter in
13		wash, color changes from
14		grey to brown to grey
15		
16		
17		
18		
19		
20	↓ 3/6"	19:04
21	20	
22	27	56 bl/min
23	40	
24	36	
25	37	
26	25	59 bl/min
27	23	
28	42	57 bl/min
29	60	
30	45/6" 17	Jet again 19:15
31	49	
32	51	
33	58	
34	58	
35	42/10"	19:45
	56/6"	restrike 10/20/78



Dynamic measurements
Sequence No / Depth ft yes
01 (PDA) 30'-34'10"
02 restrike (PDA) 34'10" - 35'-4"

Notes:
Pile batter at E.O.D.
2.1% N
0.6% W

□ Capacity, Kips
■ Restrike
▽ Jetting depth

WCC, 77C 835, Phase II
Vol III A

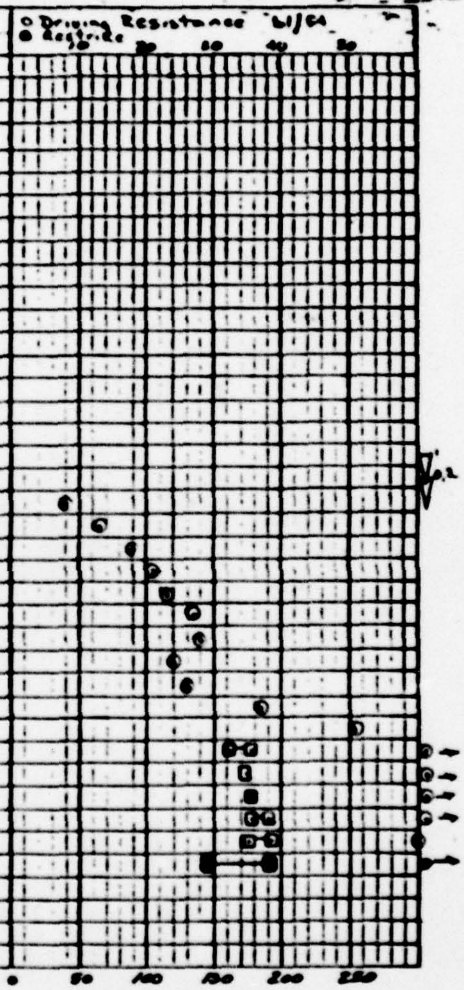
10 Oct 79

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 08 01 160 1 2200

Pile Type	Douglas Fir	Hammer	Vulcan V-1	Date	16 Oct 78
Pile length	42'	Energy	15,000	Time	2045 → 2233
Ground el.	Trench Level	Operating Rate	60 bl/min	Inspector	Aggarwal

Depth ft	Blows	Remarks
0-1	↓	20:45
2		
3		
4		Pile sinks 10'4"
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		Jet to 19'
16		
17		
18		
19	↓	21:40
20	8	Jet to 20' with jet on
21	13	E side
22	18	54 bl/min
23	21	
24	23	
25	27	57 bl/min
26	28	
27	24	
28	26	
29	37	
30	51	22:00
31	66	
32	60	60 bl/min
33	64	
34	70	
35	60	22:33
	43/6"	restrike 10/20/78



□ Capacity, kips
■ Restrike
▽ Jetting depth

Dynamic Measurements

Sequence No	Depth ft
01 (PDA)	30-35'
02 restrike (PDA)	35'-35'6"

Notes:
Pile Batter at 0.00
0.2% S
2.0% E

M.C.L.
18 Oct '78

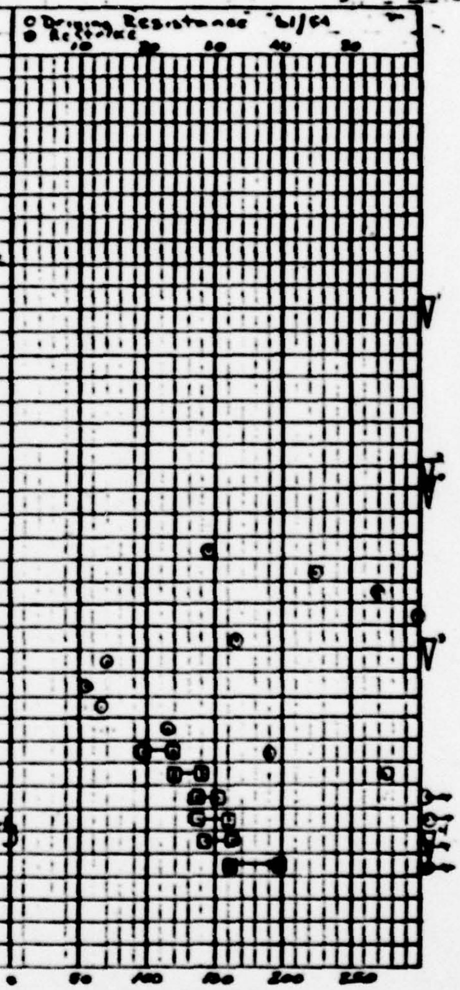
WCC, 77C815, Phase III
Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 08 01 160 1 1100

Pile Type Douglas Fir   Hammer Vulcan V-1   Date 17 Oct 78
Pile length 41.7   Energy 15,000   Time 1043-1200
Ground el. trench level   Operating Rate 60 bl/min   Inspector - TSO

Depth ft	Blows	Remarks
0-1		1043
2		
3		
4		Pile sinks 7'6"
5		
6		
7		
8		
9		Jet to 12' with jet pipe
10		on NE side
11		
12		
13		Jet to 19'0" with jet pipe
14		on NE
15		At 15' [illegible] comes up
16		with wash
17		
18		
19		
20		
21		
22	29	
23	45	
24	54	
25	60	63 bl/min; jet to 27'
26	39	
27	14	leave jet running and
28	11	drive to 24'6" [illegible]
29	13	
30	23	
31	32/10"	
32	55	
33	72	
34	103	Hammer functioned improperly
35	78/6"	12:00
	64/6"	restrike 10/20/78



Dynamic measurements Yes

Sequence No.	Depth ft
01 (PDA)	30-34'6"
02 restrike (PDA)	34'6"-35

□ Capacity, kips
■ Restrike
▽ Jetting

Notes:
Pile batter at E.O.D.
0.0% S
2.3% E

WCC, VTC EIS, Phase V
Vol III A

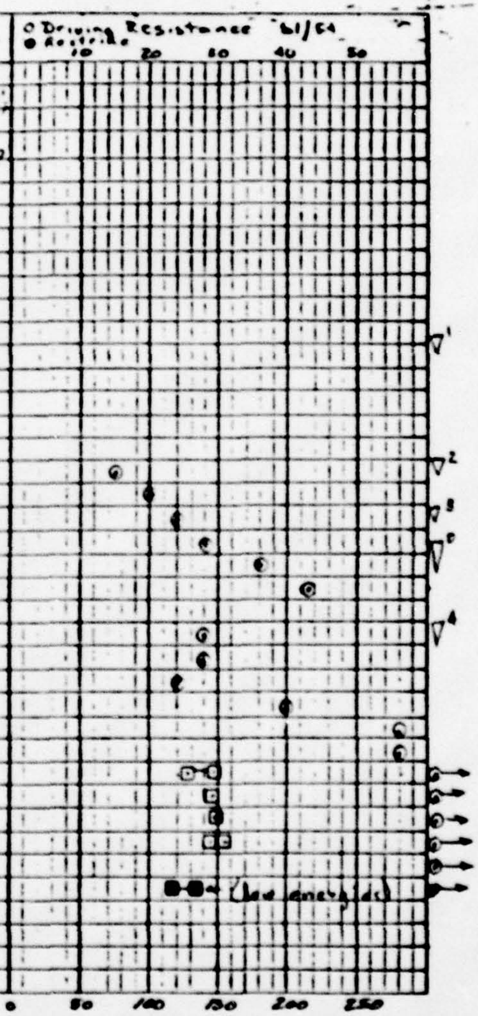
√ DSI
10 Oct 78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

I D No. 03 01 160 1 1800

Pile Type	Douglas Fir	Hammer	Vulcan #1	Date	17 Oct 78
Pile length	62'	Energy	15,000	Time	1345 → 1630
Ground el.	Trench level	Operating Rate	60 bl/min	Inspector	TEO

Depth ft	Blows	Remarks
0-1	↓	13:45 During prejet, jet
2		loses circulation at 22';
3		pipe goes only to 23';
4		much Yagente coming up
5		
6		Pile sinks 8'
7		
8		
9		
10		Jet to 12'6" with jet on
11		SE side.
12		
13		
14		
15		pile runs to 15'6" but
16		walks 2.5" N
17	↓	
18	15	
19	20	
20	24	
21	28	
22	36	
23	43	
24	↓	Jet to 25'
25	28	
26	28	
27	24	58 bl/min
28	40	
29	56	62 bl/min
30	56	
31	63	
32	75	62 bl/min
33	151	
34	86	
35	80	16:30
	58/6"	restrike 10/20/78



○ Capacity, Kips
● Restrike
▽ Jetting depth

Dynamic Measurements Yes

Sequence No	Depth ft
01 (PDA)	30'-34'6"
02 restrike (PDA)	34'6"-35'

Notes:
Pile Batter at E.O.D.
8.5% N
0.8% E

WCC, 77C815, Phase II
Vol III A

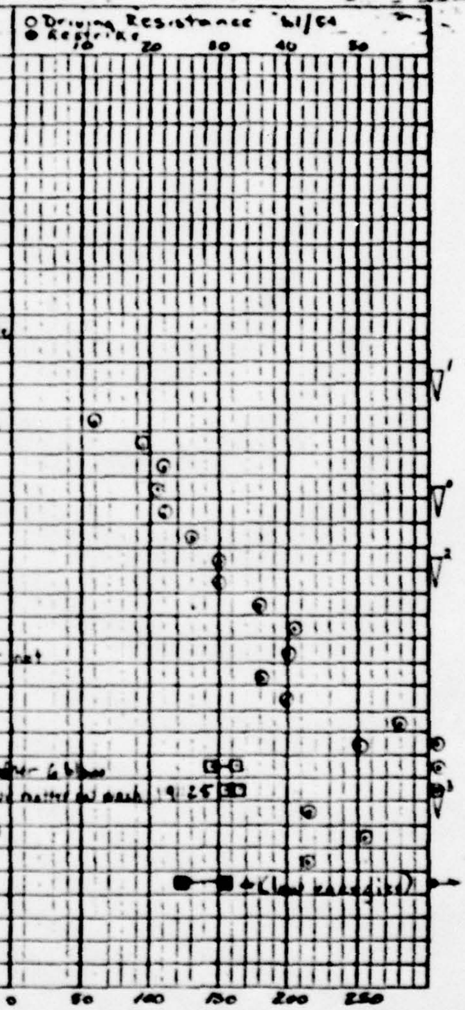
10 Oct '78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 03 01 160 1 0500

Pile Type Douglas Fir (I) Hammer Vulcan V-1 Date 17 Oct 78
Pile length 42.1' Energy 15,000 Time 1755 → 1935
Ground el. Trench Level Operating Rate 60 bl/min Inspector Aggarwal

Depth ft	Blows	Remarks
0-1	↓	17:55
2		
3		
4		Pile sinks 10'4"
5		
6		
7		
8		
9		
10		
11		
12		Jet to 15'; jet on S side
13		
14		
15	↓	18:10
16	12	Stopped once after 5 blows
17	19	
18	22	
19	21	
20	28	58 bl/min
21	26	
22	30	
23	20	59 bl/min
24	36	
25	41	Leads moving up & down.
26	40	stopped after 11 blows, hammer not following correctly
27	36	
28	40	
29	56	Jet to 23' 18:20
30	50	18 30
31	77	Stopped to remove spacer after 6 blows
32	66	Jet to 32' on SE Side; stopped hammer [illegible] 19:25
33	29/8"	4" under water, due to jetting
34	51	
35	28/2"	19:35
	74/6"	restrike 10/20/78



O Capacity, Kips
● Restrike
▽ Jetting depth

Dynamic measurements yes

Sequence No	Depth ft
01 (PDA)	30'-35'
02 restrike (PDA)	35'-35'6"

Notes:
Pile batter at E.O.D.
3.6% S
3.0% W

WCC, 77C B26, Phase IV, Vol III A

[signature]
10 Oct '78

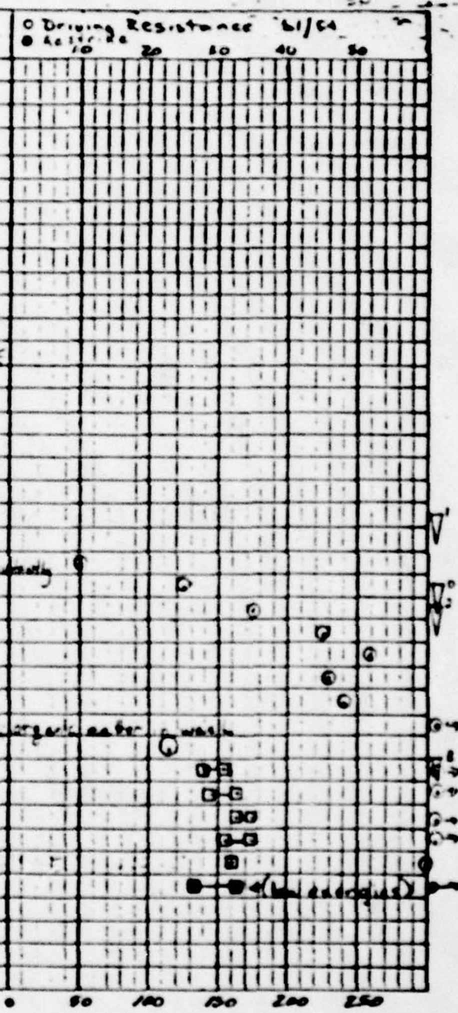
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 02^0

Pile Type: Douglas Fir (t) Hammer: Vulcan V-1 Date: 17 Oct 78
Pile length: 42' Energy: 15,000 Time: 2130 → 2315
Ground el.: Trench level Operating Rate: 60 bl/min Inspector: Aggarwal

Depth ft	Blows	Remarks
0-1		21:30
2		
3		
4		Pile sinks 11'8"
5		
6		
7		
8		
9		
10		
11		
12		21:43
13	9	Pile walking W; jetted SE
14		
15		
16		
17		Jet to 21'
18		
19		
20		
21		
22	10	Hammer falling improperly intermittently
23	25	
24	35	
25	45	
26	52	61 bl/min
27	46	
28	45	60 bl/min
29	69	22:05 Jetted to 25' on S side organic matter washed
30	23	22:15
31	60	
32	69	22:45
33	66	
34	74	Hammer Release (Stones)
35	60	
	49/6"	restrike 10/21/78



Dynamic Measurements yes

Sequence No	Depth ft
01 (PDA)	30-35'
02 restrike (PDA)	35-35'6"

□ Capacity, Kips
■ Restrike
▽ Jetting depth

Notes:
Pile batter at E.O.D.
0.5% N
0.2% E

WCC, VTC 815, Phase II
Vol III A

18 Oct '78

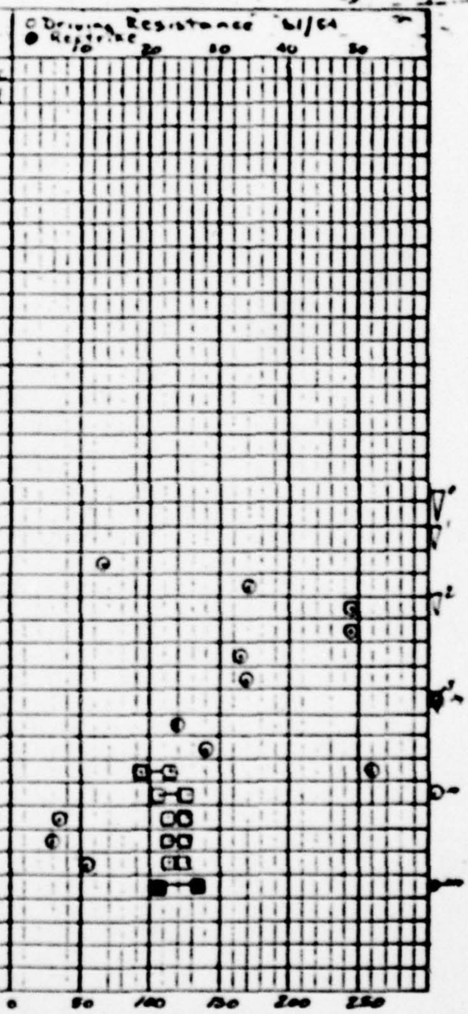
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 27^0

Pile Type	Douglas Fir	Hammer	Vulcan V-1	Date	18 Oct 78
Pile length	42'	Energy	15,000	Time	2300 → 0040
Ground el.	Trench Level	Operating Rate	60 bl/min	Inspector	Aggarwal

Depth ft	Blows	Remarks
		2300
0-1		During predrilling, organic
2		matter in wash at 10' and
3		20'
4		
5		
6		Pile sinks 11'8"
7		
8		
9		
10		
11		
12		
13		
14		
15		Jet to 21'
16		
17		
18		
19		
20		
21		23:40
22	13	
23	34	
24	49	
25	49	
26	33	
27	34	
28	72	Jet to 24'
29	24	
30	28	2400
31	52	
32	86	Jet to 28'; organic
33	7	matter in wash; piece of
34	6	wood 1' long returned
35	11	in wash 0040
	44/6"	restrike 10/20/78



Dynamic Measurements yes

Sequence No	Depth ft
01 (PDA)	20-24'6"
02 restrike (PDA)	34'6"-35'

Notes:
Dia. butter at E.O.D.
1.7% S
0.2% E

□ Capacity, kips
■ Restrike
▽ Jetting depth

WCC, 77C815, Phase V
Vol III A

√ H.C.S.
10 Oct '78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 03 01 160 1 2300

Pile Type Douglas Fir(I) Hammer Vulcan V-1 Date 19 Oct 78
Pile length 42' Energy 15,000 Time 0200 → 0330
Ground el. Trench level Operating Rate 60 bl/min Inspector - Aggarwal

Depth ft	Blows	Remarks
0-1	↓	2:05
2	↓	
3	↓	
4	↓	
5	↓	
6	↓	Pile sinks 12'
7	↓	
8	↓	
9	↓	
10	↓	
11	↓	
12	↓	
13	6	
14	12	
15	18	
16	23	
17	30	
18	51	60 bl/min
19	53	
20	69	
21	19	stop driving and jet to
22	20	18'
23	44	
24	64	
25	77	
26	66	56 bl/min
27	51	
28	51	2:40
29	85	Jet to 24', jet on E side,
30	75	organic matter in wash
31	100	
32	118	Jet to 28', organic matter
33	62	in wash
34	87	
35	95	3:20
	55/6"	restrike 10/20/78

O Driving Resistance bl/ft
● Restrike
10 20 30 40 50

0 50 100 150 200 250

Dynamic measurements Yes

Sequence No	Depth ft
01 PDA	30'-34'6"
02 restrike(PDA)	34'6"-35'

Notes:
Pile batter at E.O.D
1.00% N
0.6% W

O Capacity, Kips
● Restrike
▽ Jetting depth

WCC, VTCBIS, Phase II
Vol III A

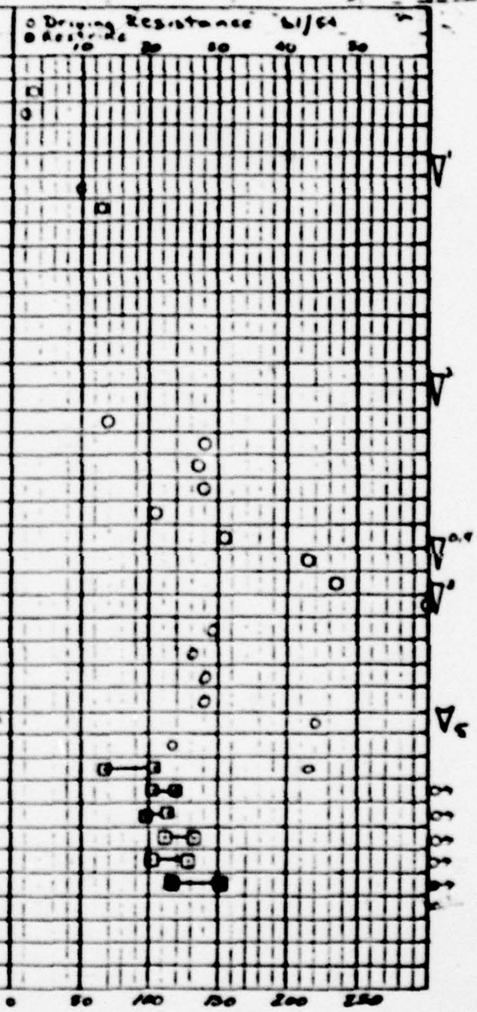
✓ G.S.T.
10 Oct '78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 03 01 160 1 26^0

Pile Type	Douglas Fir	Hammer	Vulcan V-1	Date	10/19/78
Pile length	42'	Energy	15,000	Time	0938 → 1045
Ground el.	Trench Level	Operating Rate	60 bl/min	Inspector	TRO

Depth ft	Blows	Remarks
0-1	↓	Pile sinks 1'
2	3	
3	2	
4		
5		Jet to 6'6"
6	5/6"	
7	15	
8		
9		
10		
11		Jet to 15'
12		
13		
14		
15		
16	14	
17	28	
18	27	
19	28	
20	21	
21	31	
22	43	
23	47	
24	60	
25	29	
26	26	
27	28	
28	28	
29	44	58 bl/min, Jet at 24'
30	23	Jet at 29'
31	43	56 bl/min
32	84	
33	117	Jet at 22'
34	119	64 bl/min
35	64/7.5"	60 bl/min 10:45
	40/6"	restrike 10/20/78



Dynamic Measurements

Sequence No	Depth ft
01 (PDA)	30-35'
02 restrike (PDA)	35'-35'6"

Notes:
Pile batter at E.O.D
0.0% S
0.0% N

WCC, 77C835, Phase II
Vol II A

10 Oct 78

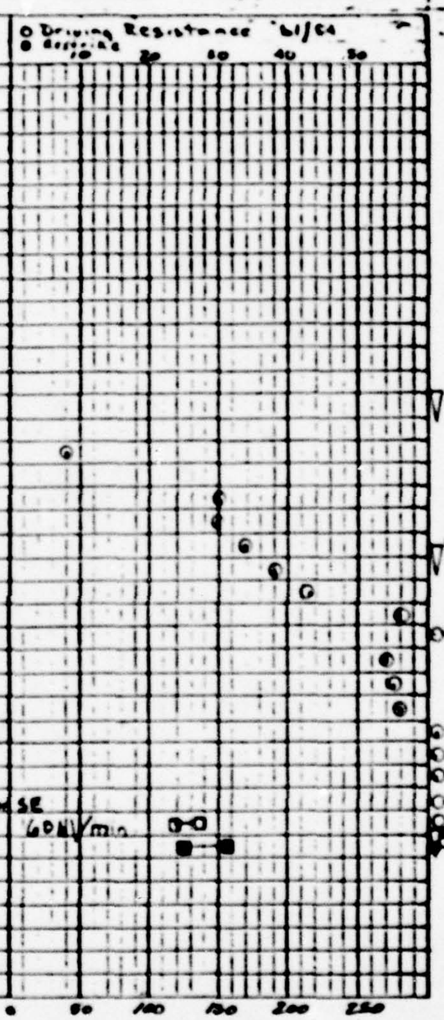
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 01 160 1 0 : 00

Pile Type	Douglas Fir	Hammer	Vulcan V-1	Date	19 Oct 78
Pile length	41' 7"	Energy	15,000	Time	1130 → 1610
Ground el.	trench level	Operating Rate	60 bl/min	Inspector	TSO

Depth ft	Blows	Remarks
0-1		11:30
2		Pile sinks 2.5'
3		
4		
5		
6		
7		
8		
9		Jet to 15' 1.5"
10		
11		
12		
13		
14		
15		
16	"jet"	
17	8	
18	No Data	taken
19	30	
20	30	57 bl/min
21	34	56 bl/min
22	38	
23	43	56 bl/min
24	56	
25	63	57 bl/min
26	54	
27	55	62 bl/min
28	56	63 bl/min
29	85	
30	153	56 bl/min 13:42
31	66/5", 78/4"	
32	57/6", 66/6"	14 40 jet running @ 34' on SE
33	38/7", 31/4"	jet running @ 38' on SE 60 bl/min
34	133/14"	restrike 10/21/78
35		



Dynamic measurements yes:

Sequence No.	Depth ft
01 (PDA)	33-33'8"
02 restrike (PDA)	33'8"-34'8"

Notes:
Pile batter at B.O.D.
3.2% N
2.5% W

□ Capacity, Kips
● Restrike
▽ Jetting depth

WCC, 77C 825, Phase V
Vol III A

✓ G.S.P.
10 Oct '78

L.3 SUMMARY LOG OF DATA ACQUIRED DURING PRELOADING, MONOLITH M1

ID No.: 07-01-010

MONOLITH(S) TESTED: M1

TEST TYPE: PRELOADING

	Sequence No.	0000	0003	0006	0007	0008
	Date/Time	12/13/78 0000	12/13 0630	12/13 0707	12/13 0907	12/13 0922
	Description of Event	INITIALIZATION	AXIAL LOAD 25% NO LATERAL	AXIAL LOAD 25% NO LATERAL	AXIAL LOAD 50% NO LATERAL	AXIAL LOAD 50% NO LATERAL
PRIMARY DATA	Dial Gages, P(1)	✓		✓		✓
	Optical Horizontal Control, P(1)	✓	ref beams only		ref beams only	
	Optical Vertical Control, P(1)	✓		✓		✓
	Tape Extensometer, P(1)	✓				
	Tilt Meters, P(1)	✓				
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓				
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓		✓		✓
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)					
	Sondex, S(12)	✓				
	Piezometers, S(13)	✓				
	Thermo-couples, S(14)	✓				✓
	Strain Gages, S(10)	✓				
	Record No. – 02	BALANCE				
	Record No. – 03	BALANCE				

Note: ✓ = Complete set of readings taken

[illegible]
Phase IV, Vol III A

ID No.: 07-01-010

MONOLITH(S) TESTED: M1

TEST TYPE: PRELOADING

	Sequence No.	0012	0016	0030	0035	0042
	Date/Time	12/13 1200	12/13 1530	12/14 0030	12/14 0404	12/14 1200
	Description of Event	AXIAL LOAD 75% NO LATERAL	FULL AXIAL LOAD NO LATERAL	FULL AXIAL LATERAL 25%	FULL AXIAL LATERAL 50%	FULL AXIAL LATERAL 75%
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	ref beams only	ref beams only	ref beams only	ref beams only	ref beams only
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)		partial	✓	✓	✓
	Tilt Meters, P(1)		✓	✓	partial	✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)		No. 11 & 27 only		✓	
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)		✓		✓	
	Surface Settlement, S(11)		✓			
	Ground Inclinometers, S(12)		✓			
	Sondex, S(12)		✓			
	Piezometers, S(13)	✓	✓		✓	✓
	Thermo-couples, S(14)		✓	✓	✓	✓
	Strain Gages, S(10)	✓	✓	✓	✓	✓
	Record No. – 02	5	6	7	8	9
	Record No. – 03	5	6	7	8	9

Note: ✓ = Complete set of readings taken

ID No.: 07-01-

MONOLITH(S) TESTED: M1

TEST TYPE: PRELOADING

	Sequence No.	0050	0058	0060	0063	0065
	Date/Time	12/14 1620	12/14 2004	12/14 2034	12/14 2050	12/14 2107
	Description of Event	FULL AXIAL & LATERAL LOADS	V = FULL H = $H_1/10$ N = 1	V = FULL = V_1 H = H_1 = FULL N = 2	V = V_1 H = $H_1/10$ N = 2	V = V_1 H = H_1 N = 3
PRIMARY DATA	Dial Gages, P(1)	✓				
	Optical Horizontal Control, P(1)	✓	partial	partial	partial	partial
	Optical Vertical Control, P(1)	✓				
	Tape Extensometer, P(1)	✓				
	Tilt Meters, P(1)	✓				
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓				
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)					
	Surface Settlement, S(11)	✓				
	Ground Inclinometers, S(12)	✓				
	Sondex, S(12)	✓				
	Piezometers, S(13)	✓				
	Thermo-couples, S(14)	✓				
	Strain Gages, S(10)	✓				
	Record No. – 02	10				
	Record No. – 03	10				

Note: ✓ = Complete set of readings taken

ID No.: 07-01-

MONOLITH(S) TESTED: M1

TEST TYPE: PRELOADING

	Sequence No.	0072	0074	0078	0079	0081
	Date/Time	12/14 2330	12/15 0012	12/15 0200	12/15 0230	12/15 0301
	Description of Event	$V = V_1$ $H = H_1/10$ $N = 3$	$V = V_1$ $H = H_1$ $N = 4$	$V = V_1$ $H = H_1/10$ $N = 4$	$V = V_1$ $H = H_1$ $N = 5$	$V = V_1$ $H = H_1/10$ $N = 5$
PRIMARY DATA	Dial Gages, P(1)					
	Optical Horizontal Control, P(1)	partial	partial	partial	partial	partial
	Optical Vertical Control, P(1)					
	Tape Extensometer, P(1)					
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)					
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)					
	Thermo-couples, S(14)				✓	
	Strain Gages, S(10)					
	Record No. – 02					
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7[illegible]
[illegible] V6 III A

ID No.: 07-01-

MONOLITH(S) TESTED: M1

TEST TYPE: PRELOADING

	Sequence No.	0083	0088	0097	0101	0106
	Date/Time	12/15 0335	12/15 0416	12/15 0627	12/15 0825	12/15 0926
	Description of Event	$V = V_1$ $H = H_1$ $N = 6$	$V = V_1$ $H = H_1$ $N = 7$	$V = V_1$ $H = H_1$ $N = 8$	$V = V_1$ $H = H_1/10$ $N = 8$	$V = V_1$ $H = H_1$ $N = 9$
PRIMARY DATA	Dial Gages, P(1)		✓			
	Optical Horizontal Control, P(1)	partial	ref beams only	partial	partial	partial
	Optical Vertical Control, P(1)		✓			
	Tape Extensometer, P(1)		✓			
	Tilt Meters, P(1)		✓			
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)		✓			
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)		✓			
	Thermo-couples, S(14)		✓			
	Strain Gages, S(10)		✓			
	Record No. – 02		11			
	Record No. – 03		11			

Note: ✓ = Complete set of readings taken

[illegible]
Phase II [illegible]

ID No.: 07-01-

MONOLITH(S) TESTED: M1

TEST TYPE: PRELOADING

	Sequence No.	0110	0114	0121	0123	0128
	Date/Time	12/15 1006	12/15 1200	12/15 1621	12/15 2020	12/15 2045
	Description of Event	$V = V_1$ $H = H_1/10$ $N = 9$	$V = V_1$ $H = H_1$ $N = 10$	$V = 0$ $H = 0$ $N = 10$	$V = V_1$ $H = H_1$ $N = 11$	$V = V_1$ $H = H_1/10$ $N = 11$
PRIMARY DATA	Dial Gages, P(1)		✓			
PRIMARY DATA	Optical Horizontal Control, P(1)	partial	✓	partial	partial	partial
PRIMARY DATA	Optical Vertical Control, P(1)	✓				
PRIMARY DATA	Tape Extensometer, P(1)	✓				
PRIMARY DATA	Tilt Meters, P(1)	✓	✓			
PRIMARY DATA						
PRIMARY DATA						
PRIMARY DATA						
SECONDARY DATA	Timber Pile Inclinometers, S(9)		✓	No. 1 & 22 only		
SECONDARY DATA	Timber Pile Slopes, S(9)					
SECONDARY DATA	Tell Tales, S(10)	✓				
SECONDARY DATA	Surface Settlement, S(11)					
SECONDARY DATA	Ground Inclinometers, S(12)		✓			
SECONDARY DATA	Sondex, S(12)		✓			
SECONDARY DATA	Piezometers, S(13)	✓	✓			
SECONDARY DATA	Thermo-couples, S(14)	✓				
SECONDARY DATA	Strain Gages, S(10)			✓		
SECONDARY DATA						
SECONDARY DATA	Record No. – 02			BALANCE		
SECONDARY DATA	Record No. – 03			BALANCE		

Note: ✓ = Complete set of readings taken

ID No.: 07·01·

MONOLITH(S) TESTED: M1

TEST TYPE: PRELOADING

	Sequence No.	0131	0135	0137	0139	0141
	Date/Time	12/15 2105	12/15 2140	12/15 2205	12/15 2217	12/15 2237
	Description of Event	$V = V_1$ $H = H_1$ $N = 12$	$V = V_1$ $H = H_1$ $N = 13$	$V = V_1$ $H = H_1/10$ $N = 13$	$V = V_1$ $H = H_1$ $N = 14$	$V = V_1$ $H = H_1/10$ $N = 14$
PRIMARY DATA	Dial Gages, P(1)					✓
PRIMARY DATA	Optical Horizontal Control, P(1)	partial	partial	partial	partial	✓
PRIMARY DATA	Optical Vertical Control, P(1)					✓
PRIMARY DATA	Tape Extensometer, P(1)					partial
PRIMARY DATA	Tilt Meters, P(1)					
PRIMARY DATA						
PRIMARY DATA						
PRIMARY DATA						
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
SECONDARY DATA	Timber Pile Slopes, S(9)					
SECONDARY DATA	Tell Tales, S(10)					
SECONDARY DATA	Surface Settlement, S(11)					
SECONDARY DATA	Ground Inclinometers, S(12)					
SECONDARY DATA	Sondex, S(12)					
SECONDARY DATA	Piezometers, S(13)					
SECONDARY DATA	Thermo-couples, S(14)					
SECONDARY DATA	Strain Gages, S(10)					
SECONDARY DATA						
SECONDARY DATA	Record No. – 02					
SECONDARY DATA	Record No. – 03					

Note: ✓ = Complete set of readings taken

[illegible]
Phase II, [illegible]

[illegible]

ID No.: 07-01

MONOLITH(S) TESTED: M1

TEST TYPE: RELOADING

	Sequence No.	0147	0149	0158	0168	0175
	Date/Time	12/16 0300	12/16 0322	12/16 0451	12/16	12/16
	Description of Event	$V = V_1$ $H = H_1$ $N = 16$	$V = V_1$ $H = H_1/10$ $N = 16$	$V = V_1$ $H = H_1$ $N = 20$	$V = V_1$ $H = H_1$ $N = 24$	$V = V_1$ $H = H_1$ $N = 27$
PRIMARY DATA	Dial Gages, P(1)			✓		
	Optical Horizontal Control, P(1)	partial	partial	partial	partial	partial
	Optical Vertical Control, P(1)					
	Tape Extensometer, P(1)					
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)					
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)			✓		
	Thermo-couples, S(14)			✓		
	Strain Gages, S(10)			✓		
	Record No. – 02					
	Record No. – 03			4		

Note: ✓ = Complete set of readings taken

ID No.: 07-01

MONOLITH(S) TESTED: M1

TEST TYPE: PRELOADING

	Sequence No.	0177	0187	0208	0211	
	Date/Time	12/16 1125	12/16 1300	12/16 1855	12/16 2335	
	Description of Event	V = V_1 H = H_1 N = 28	V = V_1 H = H_1 N = 30	V = V_1 H = H_1 N = 40	V = 0 H = 0	
PRIMARY DATA	Dial Gages, P(1)		✓	✓	✓	
	Optical Horizontal Control, P(1)	partial	✓	✓	✓	
	Optical Vertical Control, P(1)		✓	✓	✓	
	Tape Extensometer, P(1)		✓	✓	✓	
	Tilt Meters, P(1)		✓	✓		
SECONDARY DATA	Timber Pile Inclinometers, S(9)			✓ except No. 2611		
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)					
	Surface Settlement, S(11)			✓		
	Ground Inclinometers, S(12)		✓			
	Sondex, S(12)		✓			
	Piezometers, S(13)		✓	✓		
	Thermo-couples, S(14)		✓	✓		
	Strain Gages, S(10)		✓	✓	✓	
	Record No. – 02					
	Record No. – 03		5	6	8	

Note: ✓ = Complete set of readings taken

[illegible]
[illegible] Vol III

L.4 SUMMARY LOG OF DATA ACQUIRED DURING PILE DRIVING, MONOLITH M1

ID No.: 09-01-

MONOLITH(S) TESTED: M1

TEST TYPE: PDET

	Sequence No.	0000	0020	0028	0205	0212
	Date/Time	12/21/78 1030	12/21 2250	12/22 0800	12/22 1800	12/22 2300
	Description of Event	INITIALIZATION	FULL AXIAL AND LATERAL LOADS	AFTER "STABILIZATION" FULL LOADS	PILE NO. 2 ~50ft PENETRATION	PILE NO. 2 ~100ft FULL PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓		✓	✓
	Tilt Meters, P(1)	✓	✓			
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓	✓	✓		
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓				
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)	✓	PD3D1 only			
	Sondex, S(12)	✓				
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	✓
	Strain Gages, S(10)	BALANCE		✓		✓
	Record No. – 02					4?
	Record No. – 03					

Note: ✓ = Complete set of readings taken

[illegible]
[illegible]

ID No.: 09-01-

MONOLITH(S) TESTED: M1

TEST TYPE: PDET

	Sequence No.	0215	0300	0307	0312	0400
	Date/Time	12/26 2200	12/27 0750	12/27 1338	12/27 1652	12/28 0730
	Description of Event	NO LOADS	FULL AXIAL AND LATERAL LOADS ON	PILE NO. 3 ~ 50ft PENETRATION	PILE NO. 3 ~100ft FULL PENETRATION	PILE NO. 4 START
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)		✓	✓	✓	[illegible] only
	Optical Vertical Control, P(1)		✓	✓	✓	✓
	Tape Extensometer, P(1)		✓	✓	✓	
	Tilt Meters, P(1)		✓		✓	✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)		✓		✓	
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)		✓			
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)		✓		PD3D1 only	
	Sondex, S(12)		✓			
	Piezometers, S(13)		✓	✓	✓	✓
	Thermo-couples, S(14)		✓	✓	✓	✓
	Strain Gages, S(10)				✓	✓
	Record No. – 02				4	5
	Record No. – 03					

Note: ✓ = Complete set of readings taken

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Phase II & III /

ID No.: 09 - 01 -

MONOLITH(S) TESTED: M1

TEST TYPE: PDET

	Sequence No.	0404	0406	0503	0600	0603
	Date/Time	12/28 1050	12/28 1435	12/28 1705	12/29 0750	12/29 1330
	Description of Event	PILE NO 4 ~50 ft HALF PENETRATION	PILE NO. 4 ~100 ft FULL PENETRATION	PILE NO. 5 ~50 ft HALF PENETRATION	PILE NO. 6 START	PILE NO. 6 ~50 ft HALF PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	ref beams only
	Optical Vertical Control, P(1)	✓	✓	✓	✓	ref beams only
	Tape Extensometer, P(1)	✓		✓		
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)			✓		
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	✓
	Strain Gages, S(10)			✓		✓
	Record No. – 02			6		7
	Record No. – 03					

Note: ✓ = Complete set of readings taken

ID No.: 02-01-

MONOLITH(S) TESTED: M1

TEST TYPE: PDET

	Sequence No.	0606	0700	0703	0704	0709
	Date/Time	12/29 1730	12/30 0800	12/30 1330	1/2/79 0800	1/2 2340
	Description of Event	PILE NO. 6 ~100ft FULL PENETRATION	PILE NO. 7 START	PILE NO. 7 ~50ft HALF PENETRATION	PILE NO. 7 ~50ft HALF PENETRATION	PILE NO. 9 ~100ft FULL PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓		
	Optical Horizontal Control, P(1)	✓	✓	ref beams only	✓	
	Optical Vertical Control, P(1)	✓	✓	ref beams only	✓	✓
	Tape Extensometer, P(1)		✓	ref beams only	monolith only	✓
	Tilt Meters, P(1)		✓	✓		✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)		✓ except No 2 & 11			
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)					
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)		✓			
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)	✓	✓	✓	partial	✓
	Strain Gages, S(10)	✓		✓	✓	✓
	Record No. – 02	8		9	10	11
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C885
[illegible]

ID No.: 09-01-

MONOLITH(S) TESTED: M1

TEST TYPE: PDET

	Sequence No.	0803	0809	0903	0907	1000
	Date/Time	1/3 0730	1/3/79 1625	1/3 2110	1/4 0130	1/4 0730
	Description of Event	PILE NO. 8 ~50ft HALF PENETRATION	PILE NO. 8 ~100ft FULL PENETRATION	PILE NO. 9 ~50ft HALF PENETRATION	PILE NO. 9 ~100ft FULL PENETRATION	PILE NO. 10 START
PRIMARY DATA	Dial Gages, P(1)	✓			✓	
	Optical Horizontal Control, P(1)	ref beams only	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓		✓	✓
	Tape Extensometer, P(1)	✓	✓		✓	
	Tilt Meters, P(1)	✓	✓		✓	
SECONDARY DATA	Timber Pile Inclinometers, S(9)		✓ except No. 2 & 11		✓	
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓				
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)		✓ except PD3D1		PD3D1 only	
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓		✓	✓
	Thermo-couples, S(14)	✓	✓		✓	✓
	Strain Gages, S(10)		✓			
	Record No. – 02		12			
	Record No. – 03		[illegible]			

Note: ✓ = Complete set of readings taken

[illegible]
[illegible] 6' III A

ID No.: 09-01-

MONOLITH(S) TESTED: M1 TEST TYPE: PDET

	Sequence No.	1004	1008	1100	1104	1104
	Date/Time	1/4 1100	1/4 1700	1/5 0010	1/5 0305	1/5 0745
	Description of Event	PILE NO. 10 ~50ft HALF PENETRATION	PILE NO. 10 ~100ft FULL PENETRATION	PILE NO. 11 START	PILE NO. 11 ~45ft PENETRATION	PILE NO. 11 ~45ft PENETRATION
PRIMARY DATA	Dial Gages, P(1)		✓			
	Optical Horizontal Control, P(1)	ref beams only	✓	✓	✓	
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)		✓		✓	✓
	Tilt Meters, P(1)	✓				
SECONDARY DATA	Timber Pile Inclinometers, S(9)		✓ except NO 2 & 11			
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓				
	Surface Settlement, S(11)		✓			
	Ground Inclinometers, S(12)		✓			
	Sondex, S(12)		✓			
	Piezometers, S(13)		✓			
	Thermo-couples, S(14)	✓	✓			
	Strain Gages, S(10)	✓	✓			
	Record No. – 02		13			
	Record No. – 03	7	[illegible]			

Note: ✓ = Complete set of readings taken

[illegible]
Phase IV, [illegible]

ID No.: 09-01-

MONOLITH(S) TESTED: M1

TEST TYPE: [illegible]

	Sequence No.	1105	1110	1205	1208	1300
	Date/Time	1/5 1137	1/5 1645	1/5 2309	1/6 0300	1/6 0700
	Description of Event	PILE NO. 11 ~52 ft HALF PENETRATION	PILE NO. 11 ~95 ft FULL PENETRATION	PILE NO. 12 ~51 ft HALF PENETRATION	PILE NO. 12 ~94 ft FULL PENETRATION	PILE NO. 13 START
PRIMARY DATA	Dial Gages, P(1)		✓			✓
PRIMARY DATA	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
PRIMARY DATA	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
PRIMARY DATA	Tape Extensometer, P(1)	✓	✓	✓	✓	
PRIMARY DATA	Tilt Meters, P(1)	✓	✓	✓		
PRIMARY DATA						
PRIMARY DATA						
PRIMARY DATA						
SECONDARY DATA	Timber Pile Inclinometers, S(9)		✓ except No. 2 & 11	✓ except No. 2 & 11		
SECONDARY DATA	Timber Pile Slopes, S(9)					
SECONDARY DATA	Tell Tales, S(10)					✓
SECONDARY DATA	Surface Settlement, S(11)		✓	✓	✓	
SECONDARY DATA	Ground Inclinometers, S(12)		✓	PD3D1 [illegible]		✓
SECONDARY DATA	Sondex, S(12)					
SECONDARY DATA	Piezometers, S(13)	✓	✓	✓	✓	✓
SECONDARY DATA	Thermo-couples, S(14)					✓
SECONDARY DATA	Strain Gages, S(10)		✓	✓	✓	✓
SECONDARY DATA						
	Record No. – 02		14	15	16	17
	Record No. – 03					[illegible]

Note: ✓ = Complete set of readings taken

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Phase II; 6) III A

ID No.: 09-01-

MONOLITH(S) TESTED: M1

TEST TYPE: PDET

	Sequence No.	1302	1305	1308	1310	1315
	Date/Time	1/6 1740	1/6 2030	1/7 00100	1/8 0200	1/8 0700
	Description of Event	PILE NO. 13 ~20ft PENETRATION POT RESET	PILE NO. 13 ~51ft HALF PENETRATION	PILE NO. 13 ~93ft FULL PENETRATION	PILE NO 13 ~93ft FULL PENETRATION	ZERO AXIAL AND LATERAL LOADS
PRIMARY DATA	Dial Gages, P(1)	✓			✓	
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	
	Optical Vertical Control, P(1)	✓	✓	✓	✓	
	Tape Extensometer, P(1)	✓	✓			
	Tilt Meters, P(1)		✓	✓		✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)		✓ except No. 2 & 11	✓ except No. 2 & 11		
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)			✓		
	Surface Settlement, S(11)	✓	✓			
	Ground Inclinometers, S(12)		PD3D1 only		PD3D1 only	
	Sondex, S(12)					
	Piezometers, S(13)		✓	✓		
	Thermo-couples, S(14)		✓	✓		✓
	Strain Gages, S(10)		✓	✓		✓
	Record No. – 02			18		19
	Record No. – 03		11 ?	12		13

Note: ✓ = Complete set of readings taken

Y7C2[illegible]
Pha[illegible]I, Vol III A

L.5 SUMMARY LOG OF DATA ACQUIRED DURING
LATERAL LOAD TESTING [illegible] MONO[illegible]

ID No.: 10 - 01 -

MONOLITH(S) TESTED: M1

TEST TYPE: LAT LOAD TEST

	Sequence No.	0000	0000	0001	0002	0003
	Date/Time	1/8/79 1200	1/9 1300	1/9 1715	1/9 2200	1/10 0030
	Description of Event		INITIALIZATION	V=360t H= 0	V=400t H= 0	V=360t H=0
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓		✓	
	Tilt Meters, P(1)		✓	✓	✓	
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓ except NO 2[illegible]11				
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)		✓	✓	✓	✓
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)	✓				
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	
	Thermo-couples, S(14)	✓	✓	✓	✓	
	Strain Gages, S(10)		✓			✓
	Record No. – 02		BALANCE			5
	Record No. – 03		BALANCE			5

Note: ✓ = Complete set of readings taken

ID No.: 10-01-

MONOLITH(S) TESTED: M 1

TEST TYPE: LAT LOAD TEST

	Sequence No.	0011	0021	0028	0074	0079
	Date/Time	1/10 0520	1/10 1230	1/10 2000	1/11 0700	1/11 1125
	Description of Event	V = 360t H = 72 t	V = 360t H = 108t	V = 360t H = 144t	V = 360t H ≅ 168t	V = 0 H = 0
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	
	Optical Horizontal Control, P(1)	✓	✓	✓	monolith only	monolith only
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓	✓		✓
	Tilt Meters, P(1)	✓	✓	✓	✓	
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓	✓ except No 2 & 11	✓ except No 2 & 11	No 12 only	
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)				✓	
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)	✓	✓	✓	✓	
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	
	Thermo-couples, S(14)	✓	✓	✓	✓	
	Strain Gages, S(10)	✓	✓	✓	✓	✓
	Record No. – 02	6	7	8	11	12
	Record No. – 03	6	7	8	14	15

Note: ✓ = Complete set of readings taken

Y7C-825
Phase IX ; Vol III A

L.6 COMPLETE DRIVING RECORDS OF PROTOTYPE PILES DRIVEN WITH IMPACT HAMMER, MONOLITH M1

The driving records are presented in chronological order of driving for prototype piles No. 1 through 13, driven with a VULCAN 010 hammer.

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 01 180 P 0000

Date 12/22/78

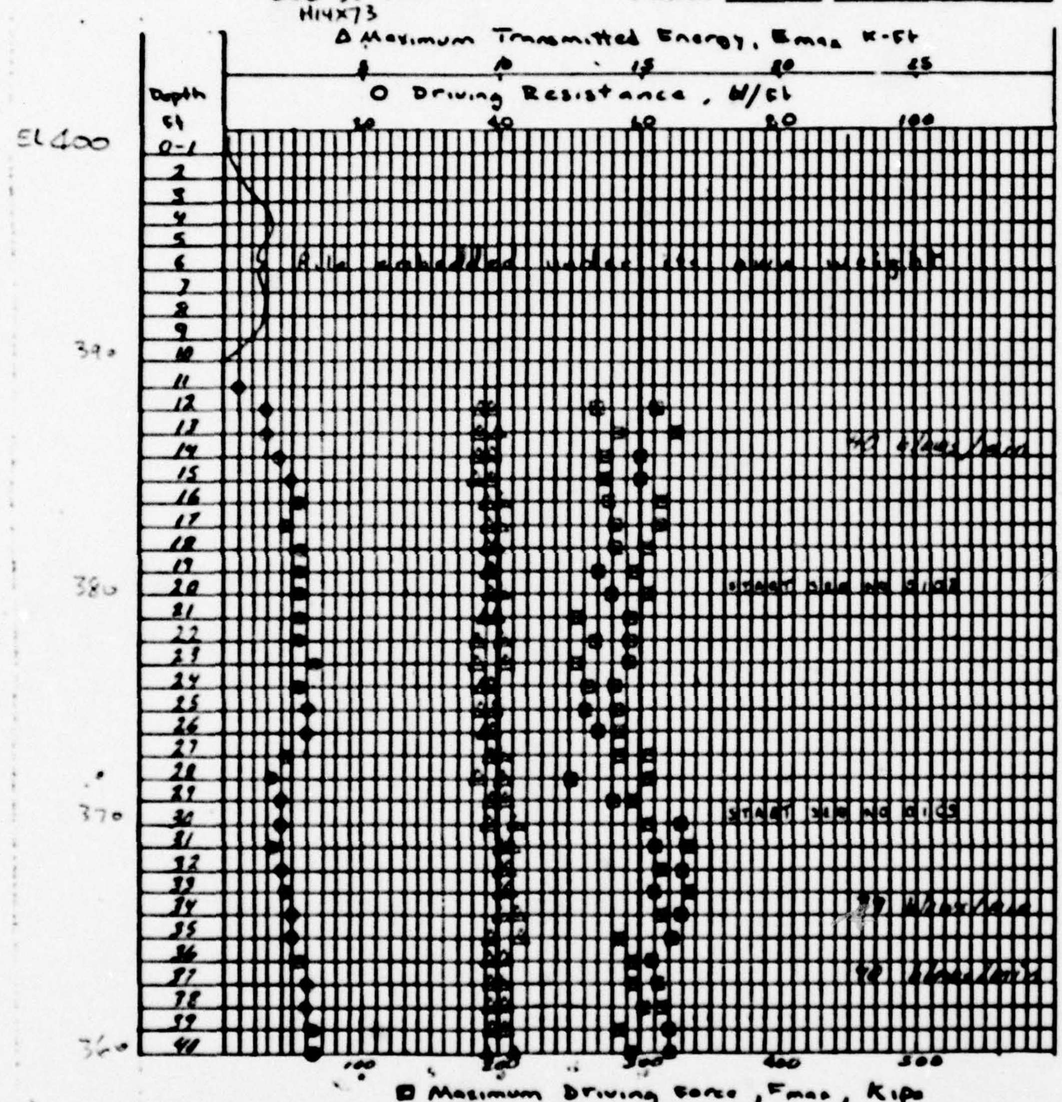
operator DB

PILE DRIVING MEASUREMENTS

PILE No. 01

200 ft M1
H14x73

	Time	Sequence No
First	11:05	0101
Finish	12:03	0105



WCC, 77C025, Phase III ; VOL II A

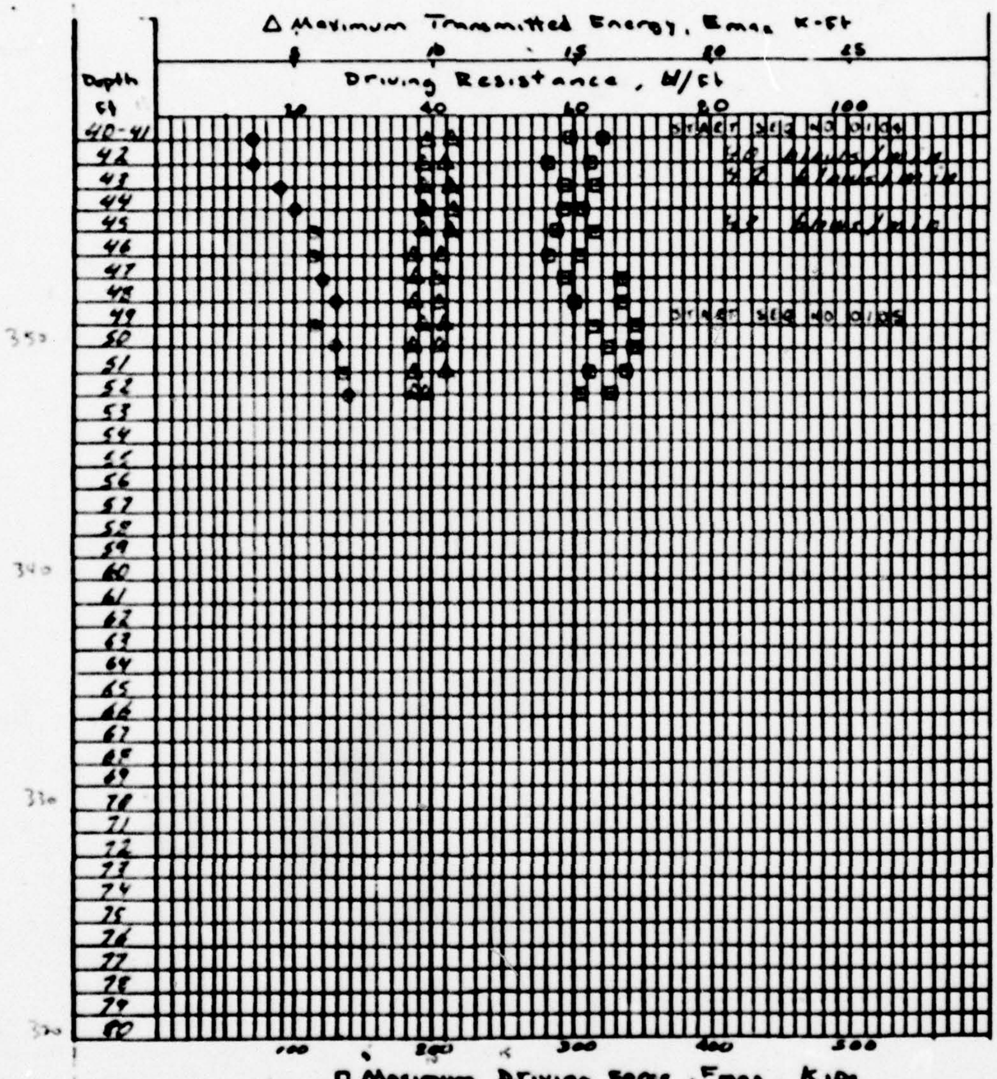
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 01 180 1 0100 P.2 of

Date 12/22/78
operator DA

PILE DRIVING MEASUREMENTS
PILE No. 01

	Time	Sequence No
First	11:06	0101
Finish		



WCC, 77C025. Phase IV ; VOL III A

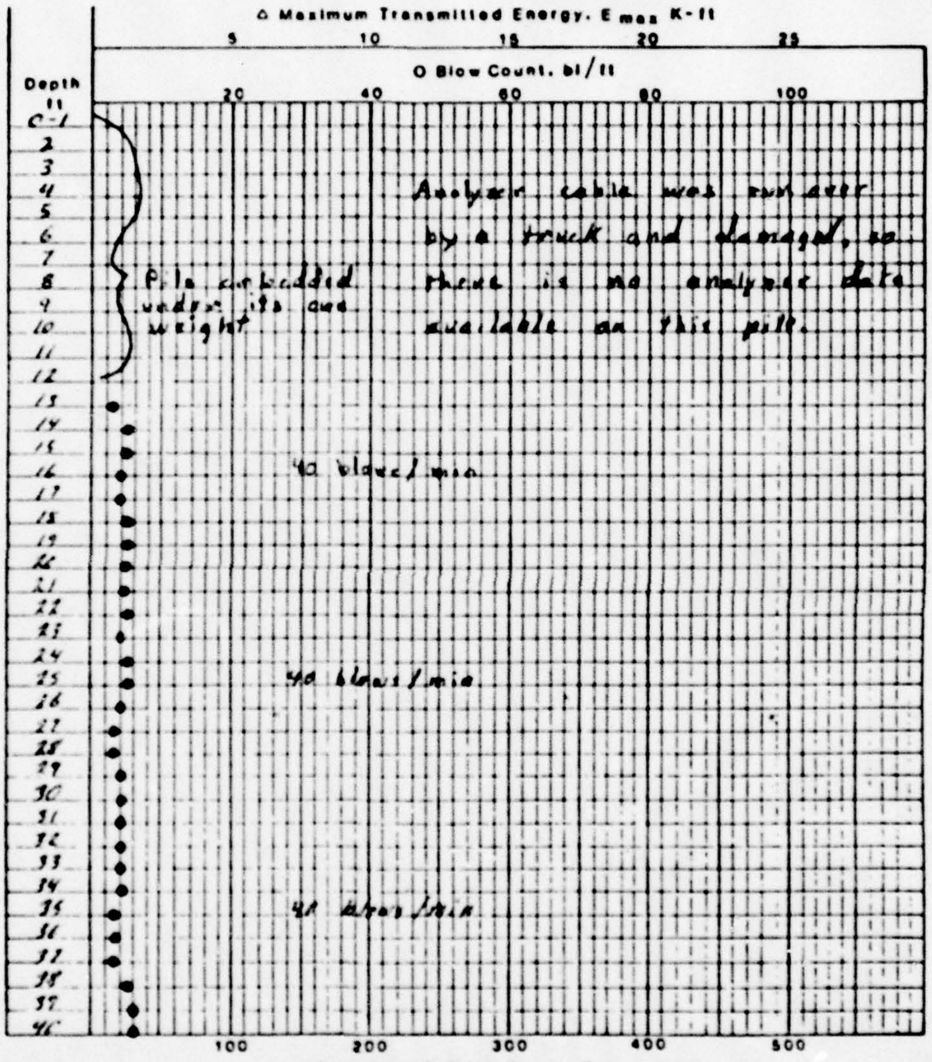
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 3
I.D. No. 09 01 180 1 0200
Date 12/22/78
Operator AA/JSL

PILE DRIVING MEASUREMENTS

PILE NO. 22
150 ft from M3

	Time	Sequence No.
First	16:40	0201
Finish	21:56	0212



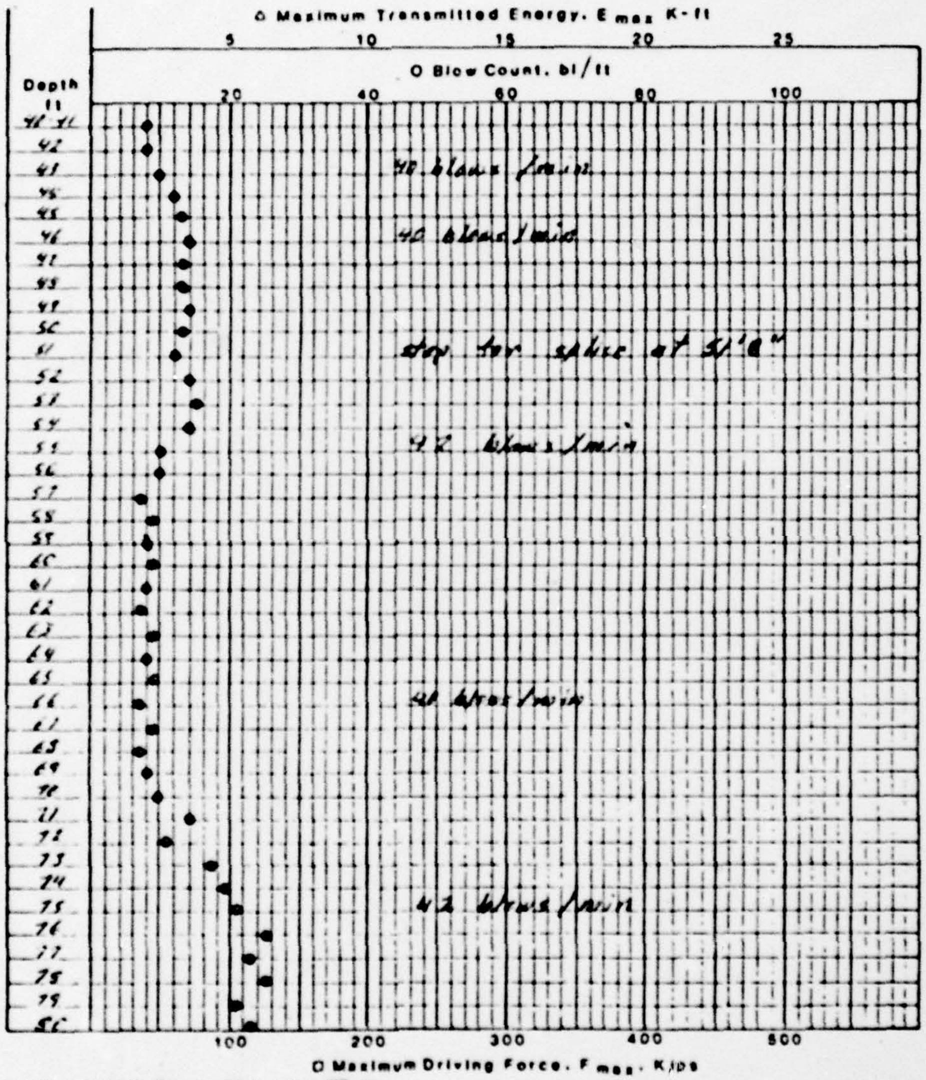
WCC. Y7C825. Phase IV Vol IIIA

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

p. 2 of 3
I.D. No. 09 01 180 1 0200
Date 12/22/78
Operator ...

PILE DRIVING MEASUREMENTS
PILE NO. 03

	Time	Sequence No.
First		
Finish		



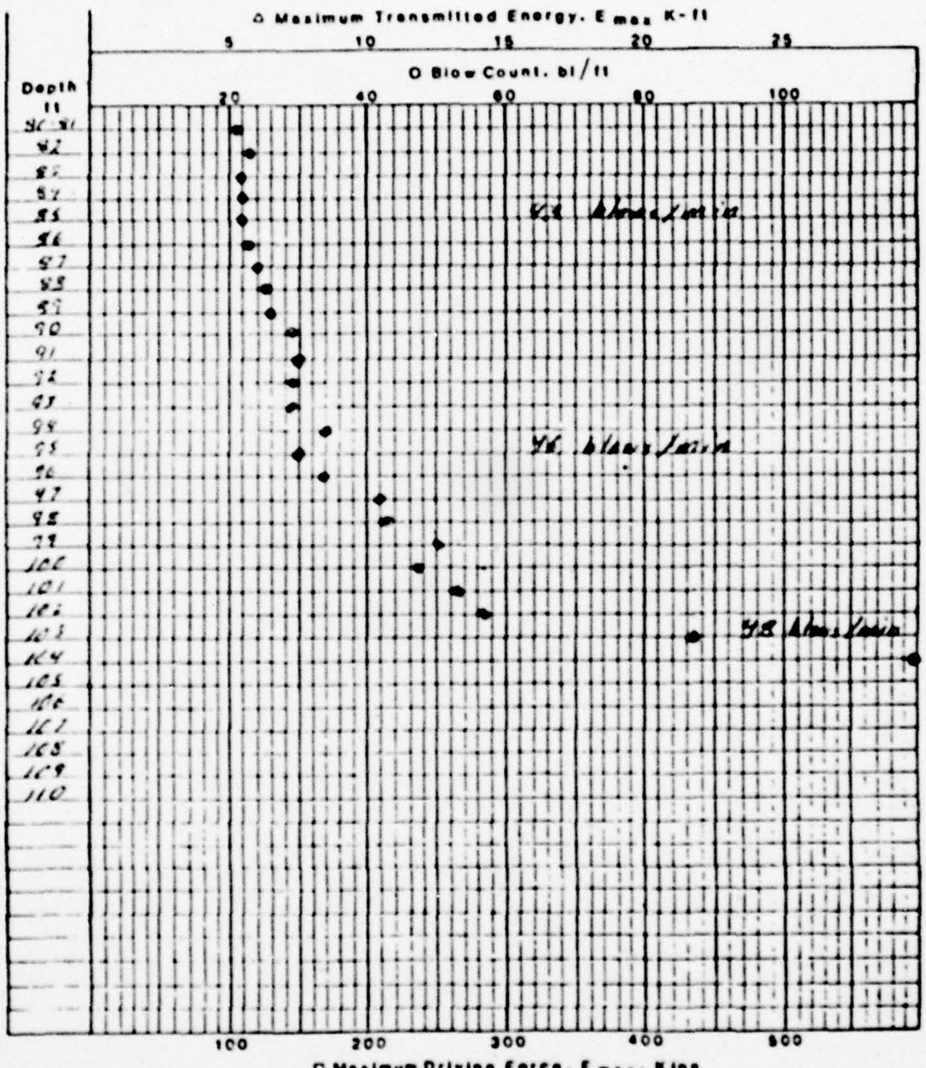
WCC. Y7C625. Phase IV ; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 2
I.D. No. 09 01 180 1 0200
Date 12/23/78
Operator JH

PILE DRIVING MEASUREMENTS
PILE NO. 02

	Time	Sequence No.
First		
Finish		



WCC. Y7C025. Phase IV; VoL IIIA

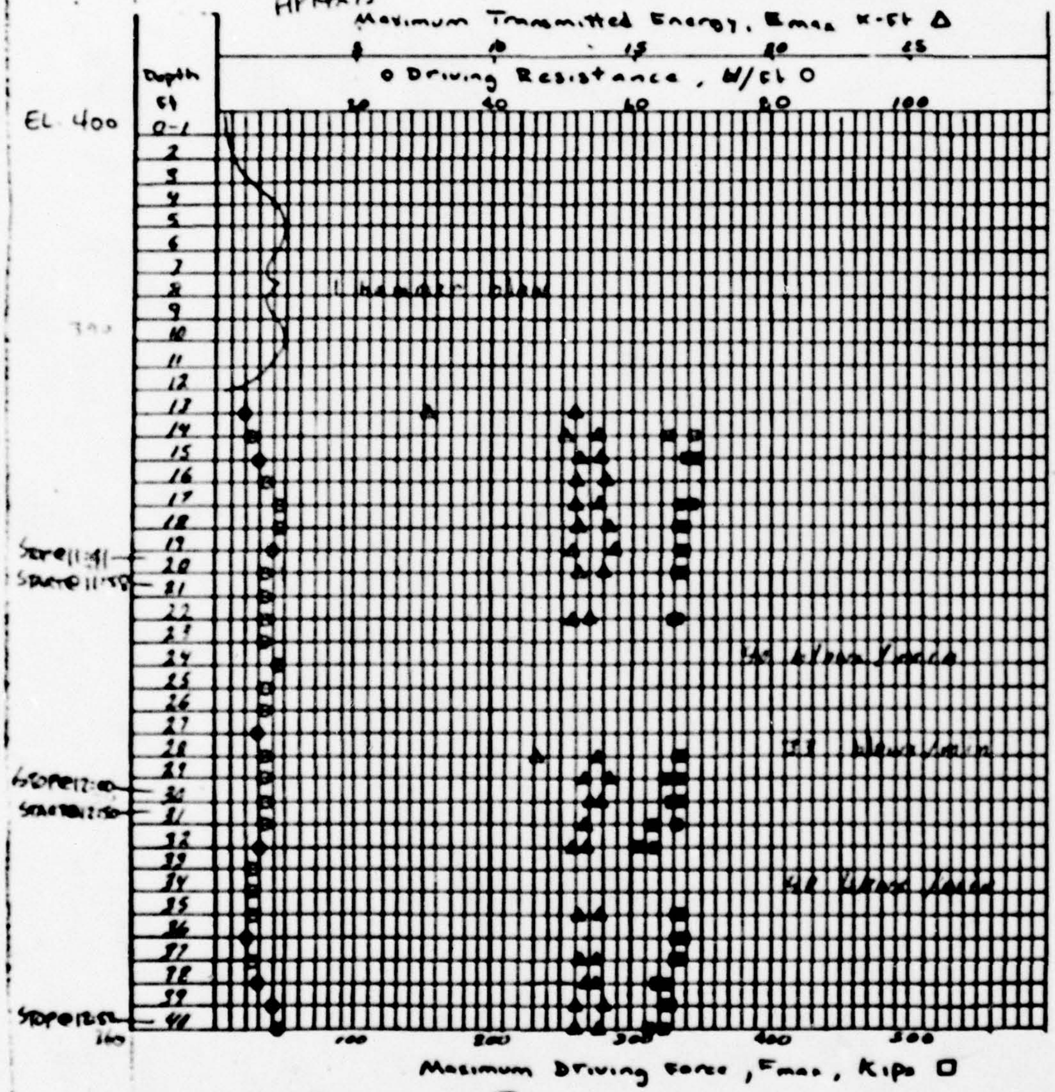
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 01 180 ... 0 00

Date 27 DEC 78
operator JSL

PILE DRIVING MEASUREMENTS
PILE No. 03
125 ft M1
HP14x73

	Time	Sequence No
First	11:39	0303
Finish	16:42	0312



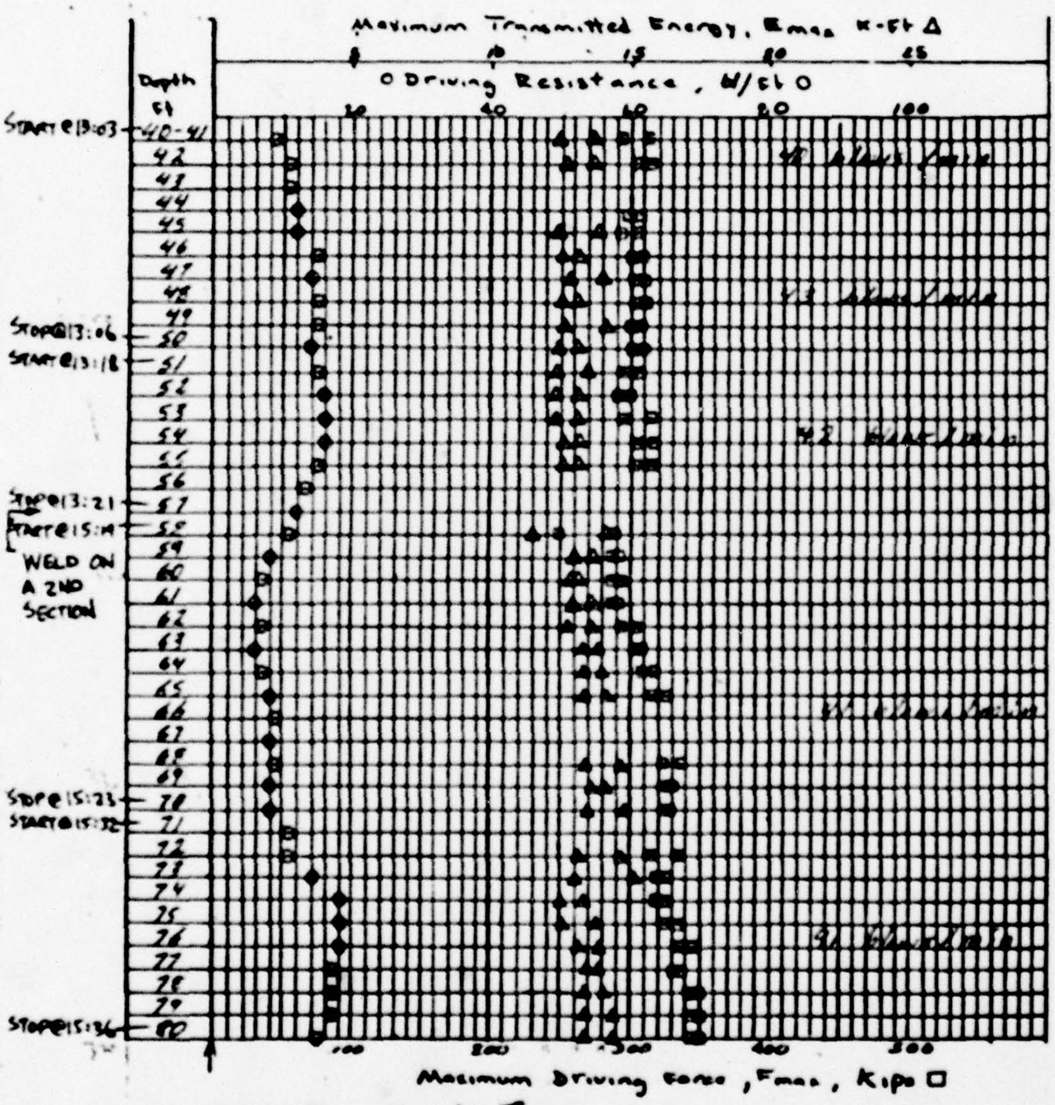
WCC; 77C0E3. Phase III; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING MEASUREMENTS
PILE No. 03

I.D. No. 09 01 180 P U 0000 (of 3)
Date 27 DEC 78
operator JSL

	Time	Sequence No
First	0303	
Finish	0312	



WCC; Y7C023; Phase III ; Vol III A

V-12

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

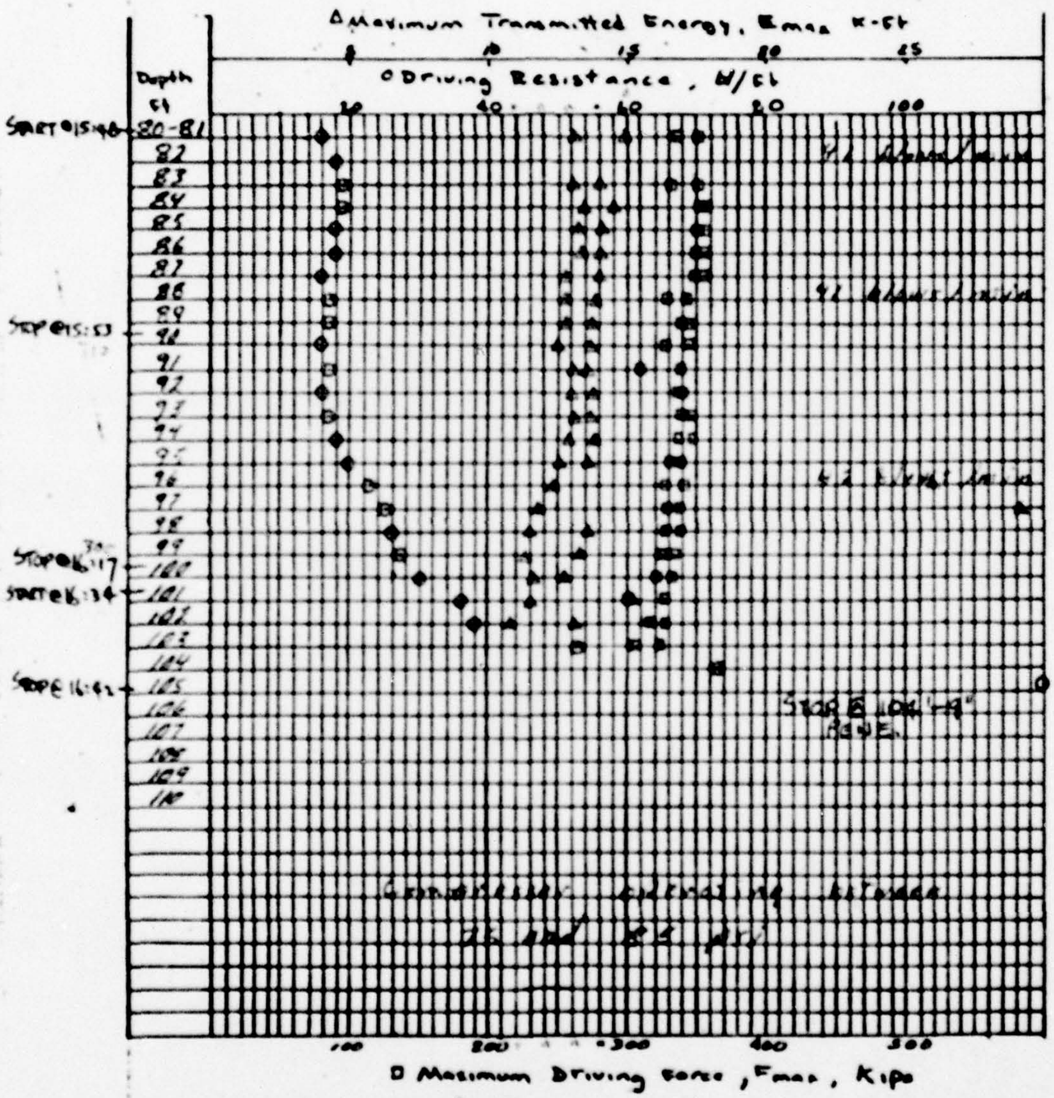
PILE DRIVING MEASUREMENTS
PILE No. 03

I.D. No. 09 01 180 P 1 of 0000

Date 27 Dec 78

operator JJL

	Time	Sequence No
First		
Finish		



WCC, 79C025; Phase III; Vol III A

HP14x73

125 ft M1

WOODWARD-CLYDE CONSULTANTS

LOCKS AND DAM No. 26

PILE DRIVING EFFECTS TEST

I.D. No. 09 01 180 B-0800

Date 28 DEC 78

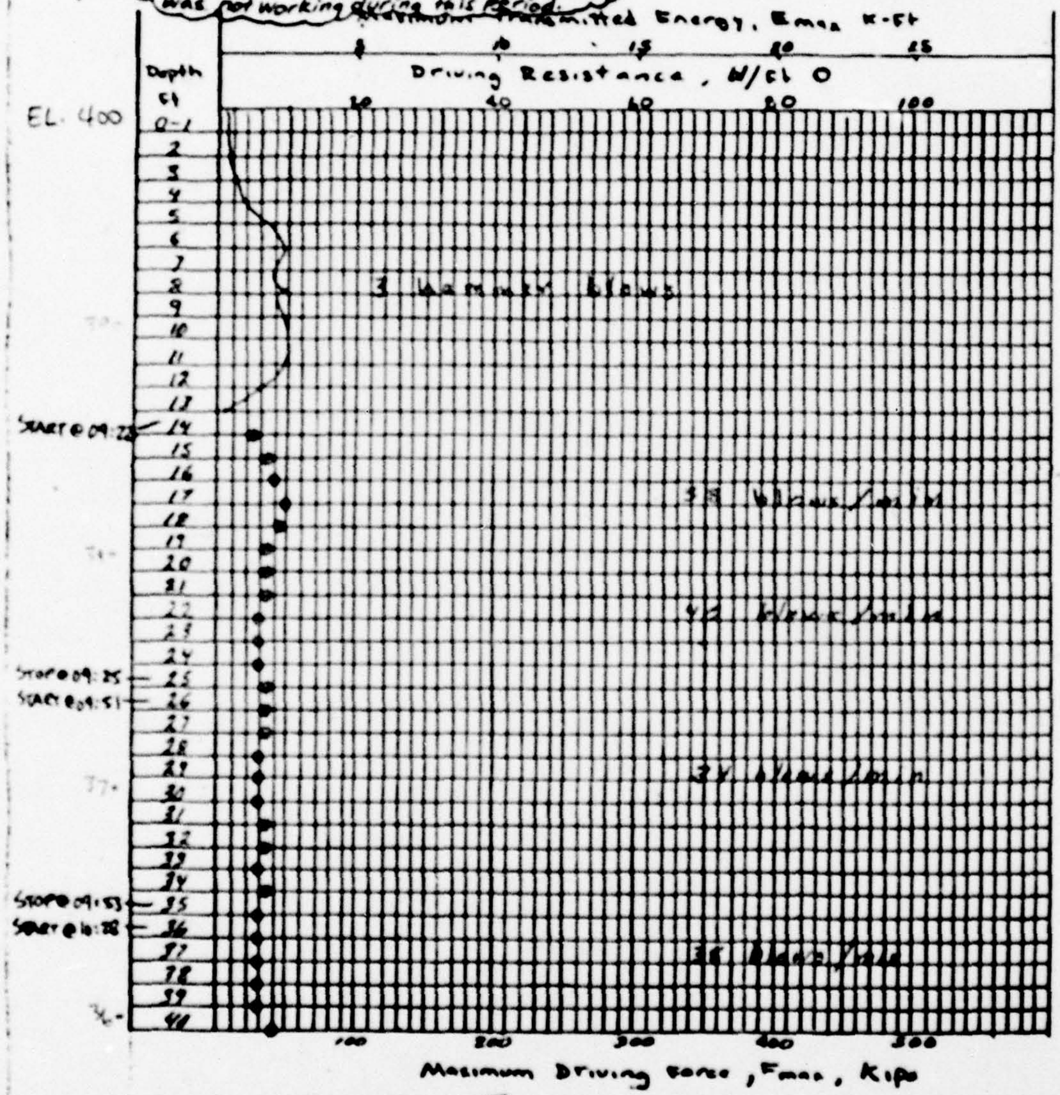
operator JSL

PILE DRIVING MEASUREMENTS

PILE No. 04

	Time	Sequence No
First	09:22	0401
Finish	14:31	0406

NOTE: Emax & Fmax are not plotted up to 33' penetration. Accelerometer was not working during this period.



WCC, 77C0ES, Phase III, VOL III A

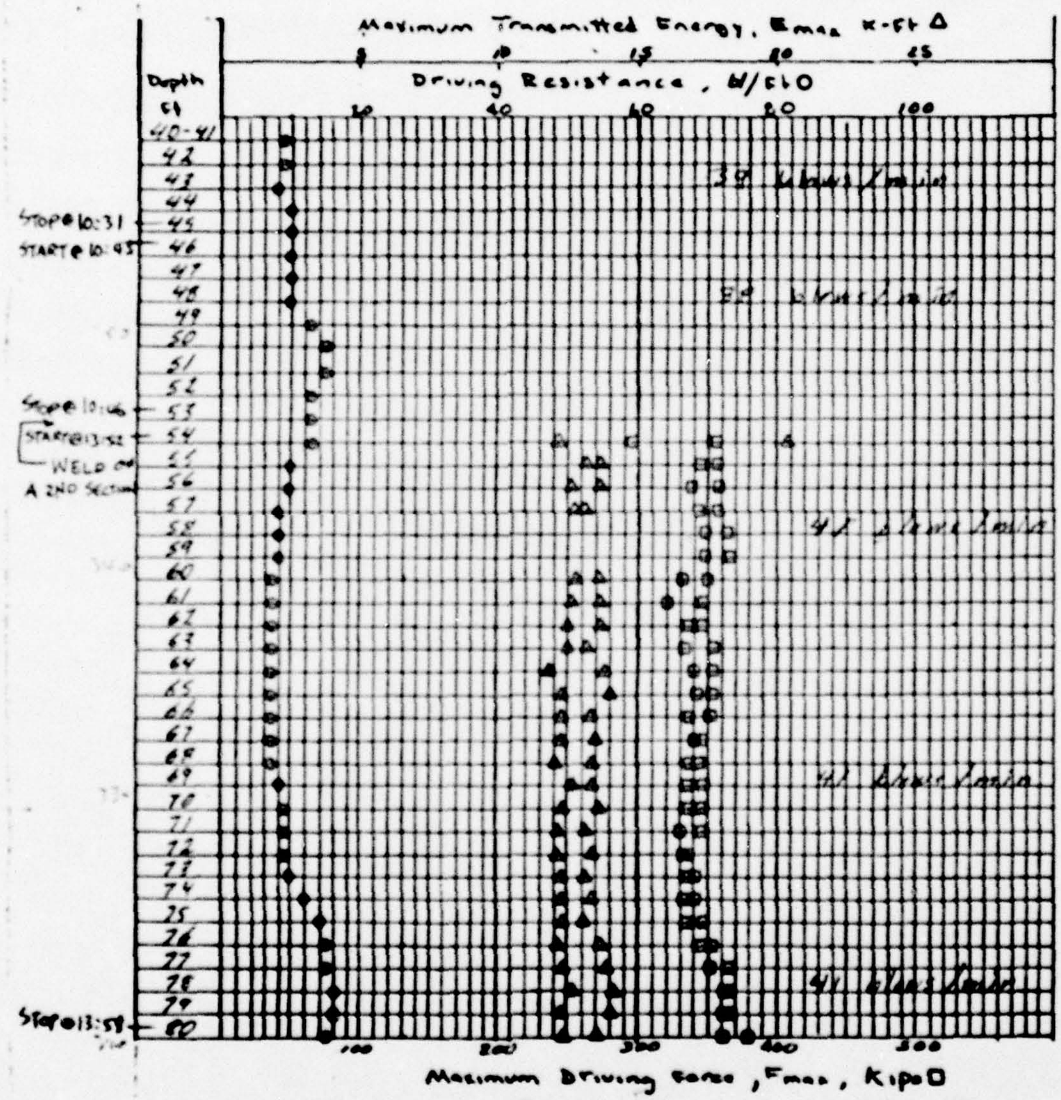
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING MEASUREMENTS
PILE No. 04

I.D. No. 09 01 180 D 0400 P. 2 of 3

Date 28 DEC 78
operator JSL

	Time	Sequence No
First	09:22	0401
Finish	14:31	0406



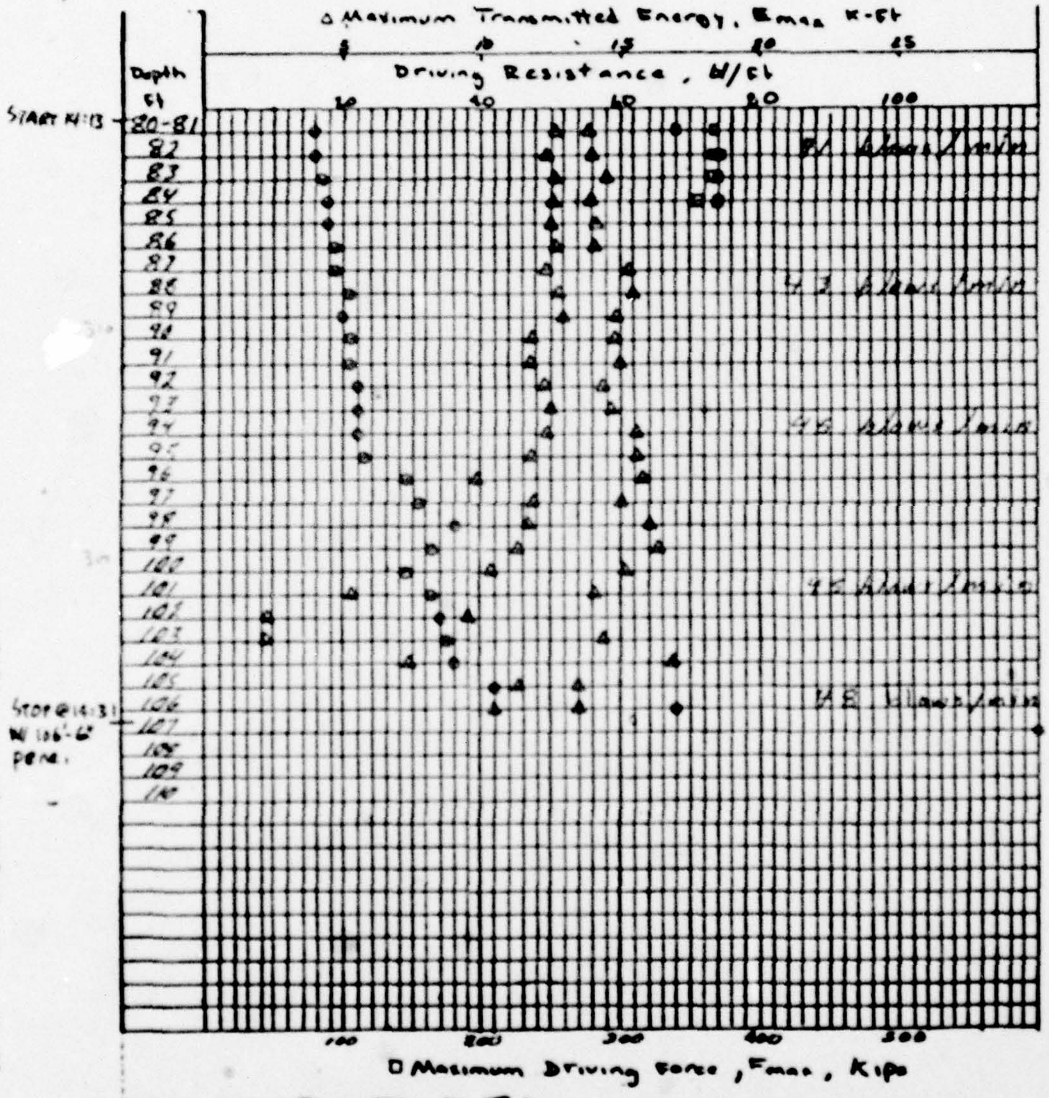
WCC, 77C025, Phase III; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING MEASUREMENTS
PILE No. 04

I.D. No. 09 01 180 0 0400 P. 3 of 3
Date 28 DEC 78
operator JSL

	Time	Sequence No
First	09:22	0401
Finish	14:31	0406



WCC, 49CB25. Phase IV; VOL III A

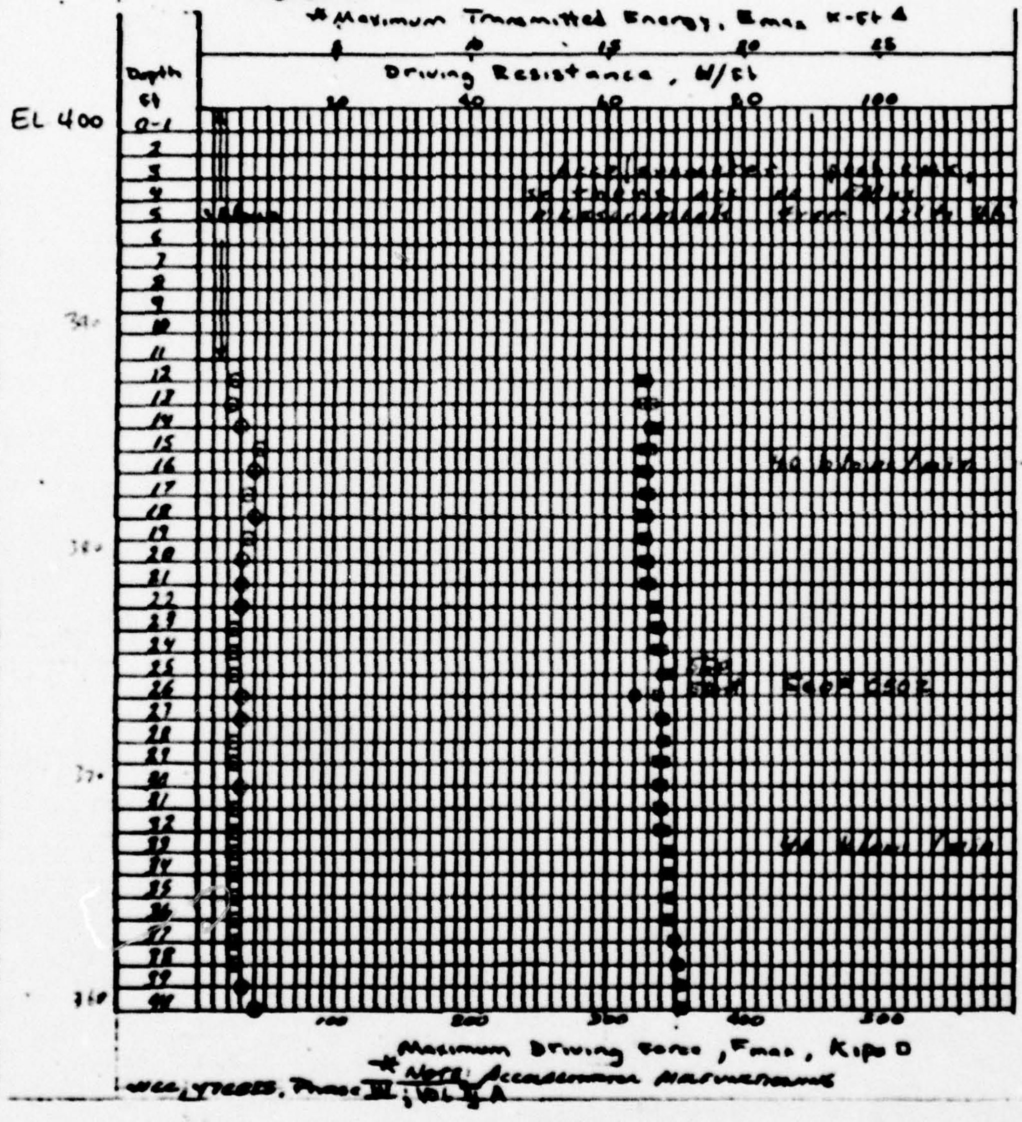
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 01 180

Date 12/20/78
operator DA

PILE DRIVING MEASUREMENTS
PILE No. 5
50' from center of Monolith M1 HP14x73

	Time	Sequence No
First	16:11	0501
Finish	16:56	0503



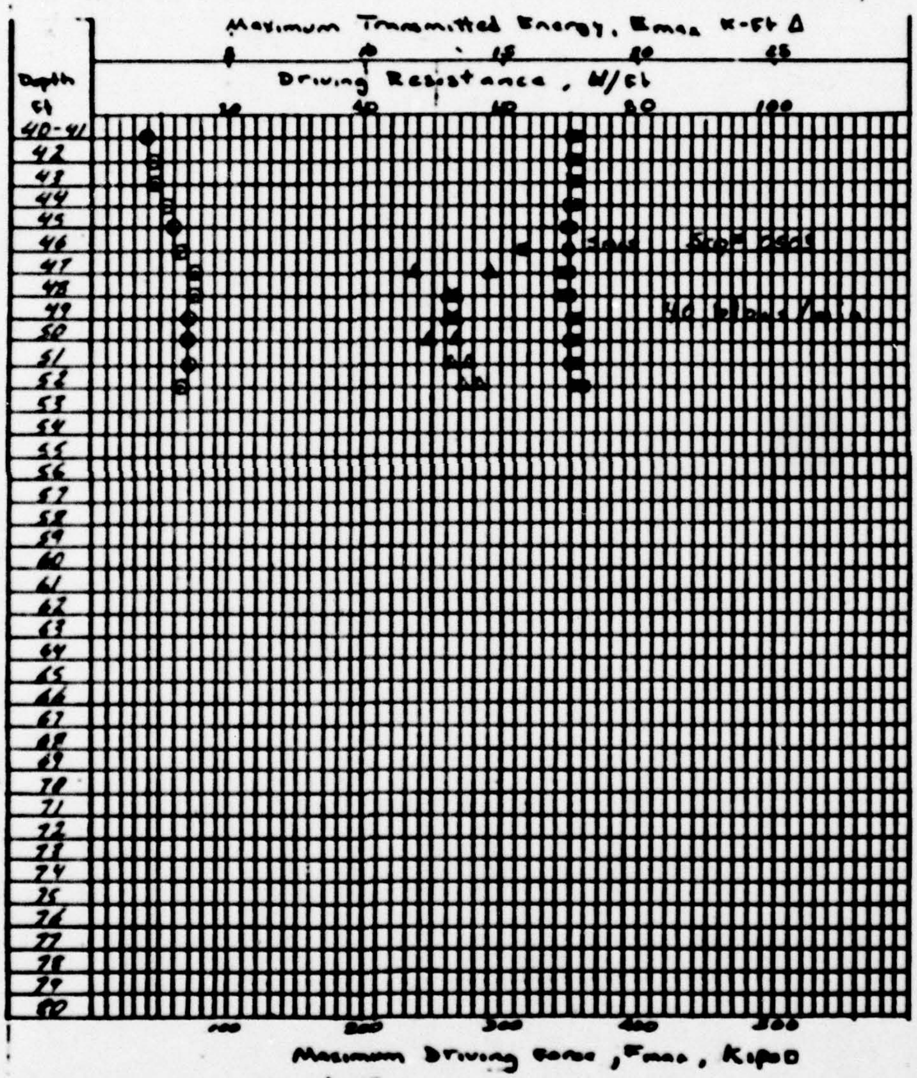
* NOTE: Accelerometer Measurements

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING MEASUREMENTS
PILE No. 05

I.D. No. 09 01 180 P. 2 of 2 0 0300
Date ______
operator ______

	Time	Sequence No
First	16:11	0501
Finish	16:56	0503



WCC 77C025. Phase III; Vol II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

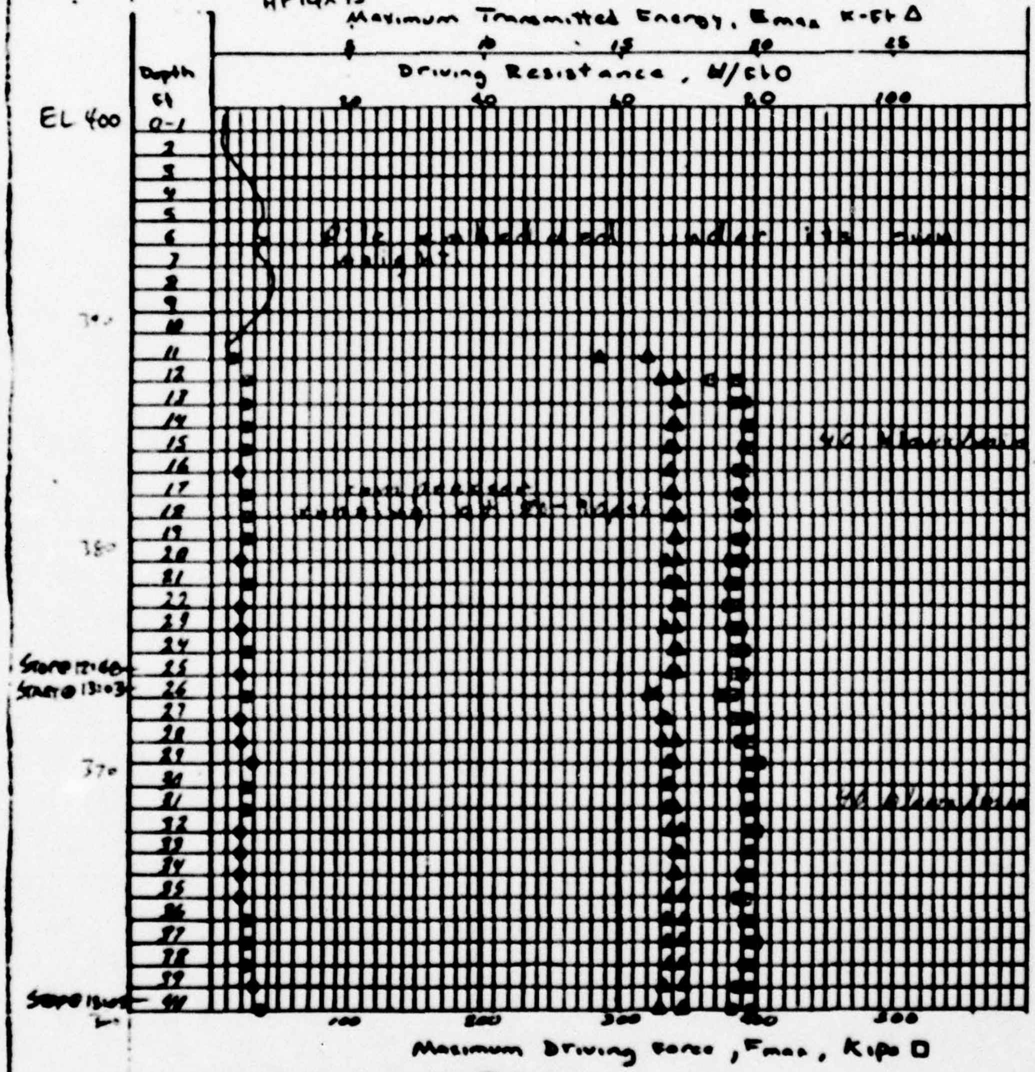
I.D. No. 09 01 180 8 0000

Date 29 DEC 78
operator JSL

PILE DRIVING MEASUREMENTS
PILE No. 06

	Time	Sequence No
First	12:47	0601
Finish	17:06	0606

30 ft M1
HP14x73



WCC. YTC083. Phase IV; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

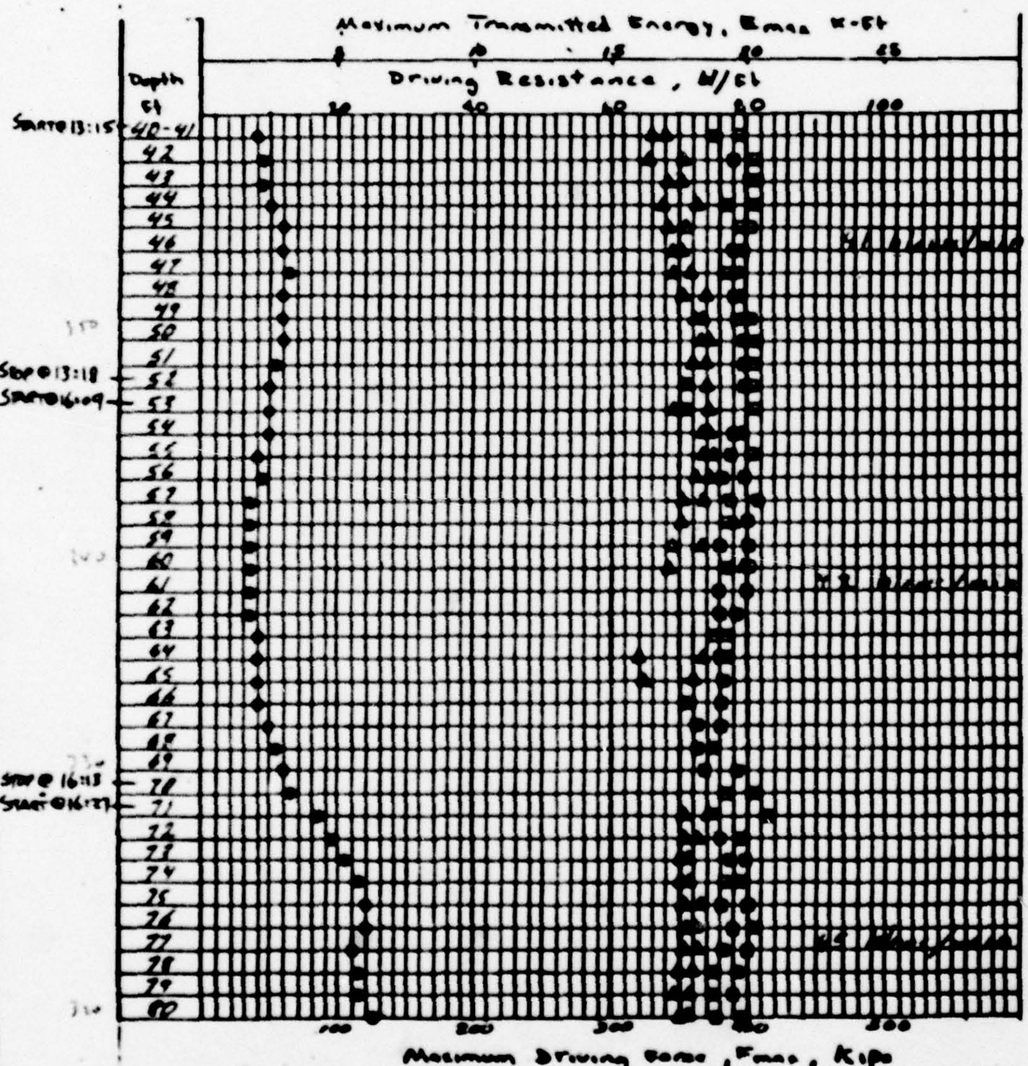
I.D. No. 09 01 180 P 0 0800 (2 of 3)

Date 29 DEC 78

operator JSL

PILE DRIVING MEASUREMENTS
PILE No. 06

	Time	Sequence No
First		
Finish		



WCC: 77C083. Phase IV; Vol. II A

L-8?

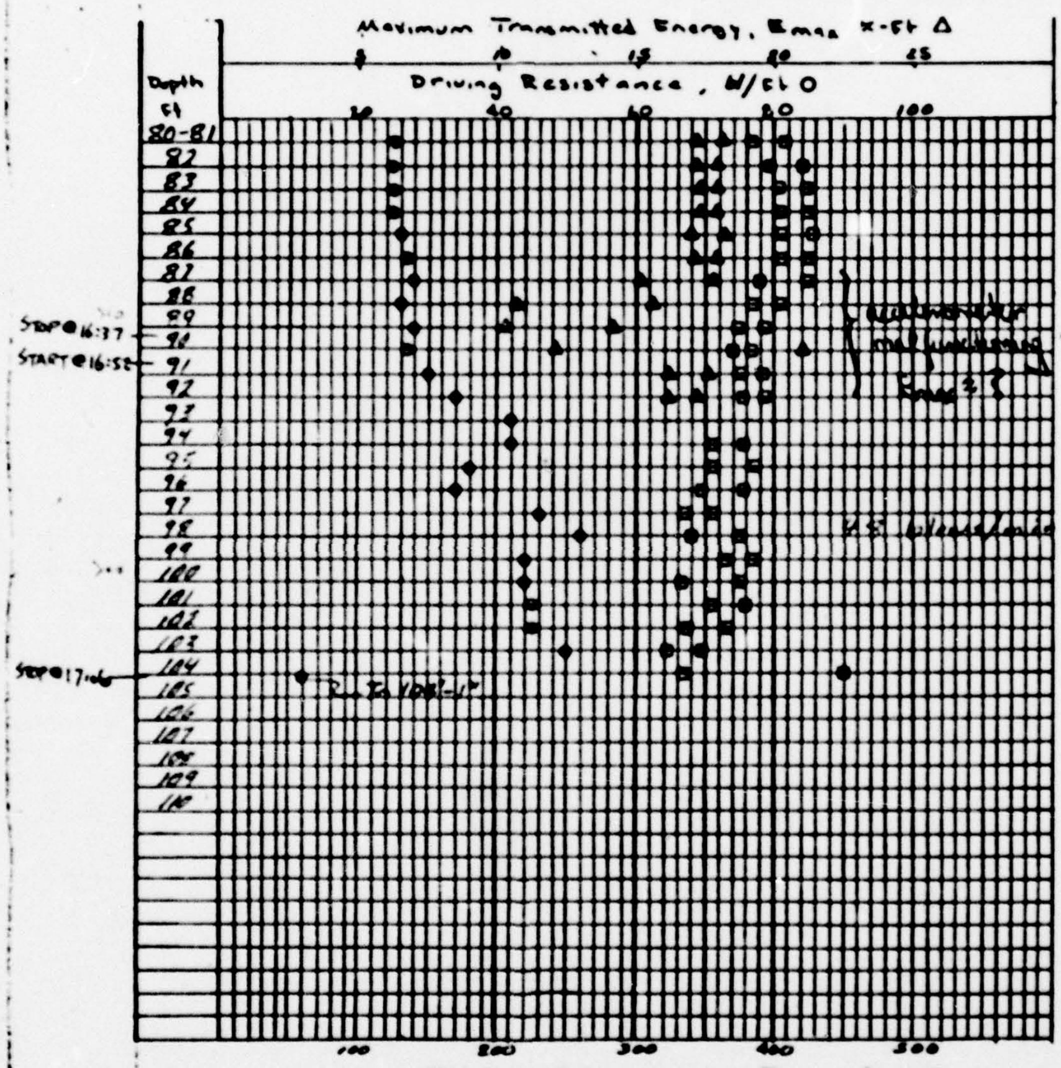
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 01 180 0 0 00 — p 3 of 3

Date ______
operator ______

PILE DRIVING MEASUREMENTS
PILE No. 06

	Time	Sequence No
First		
Finish		



WCC; YTCBES. Phase III, VOL III A

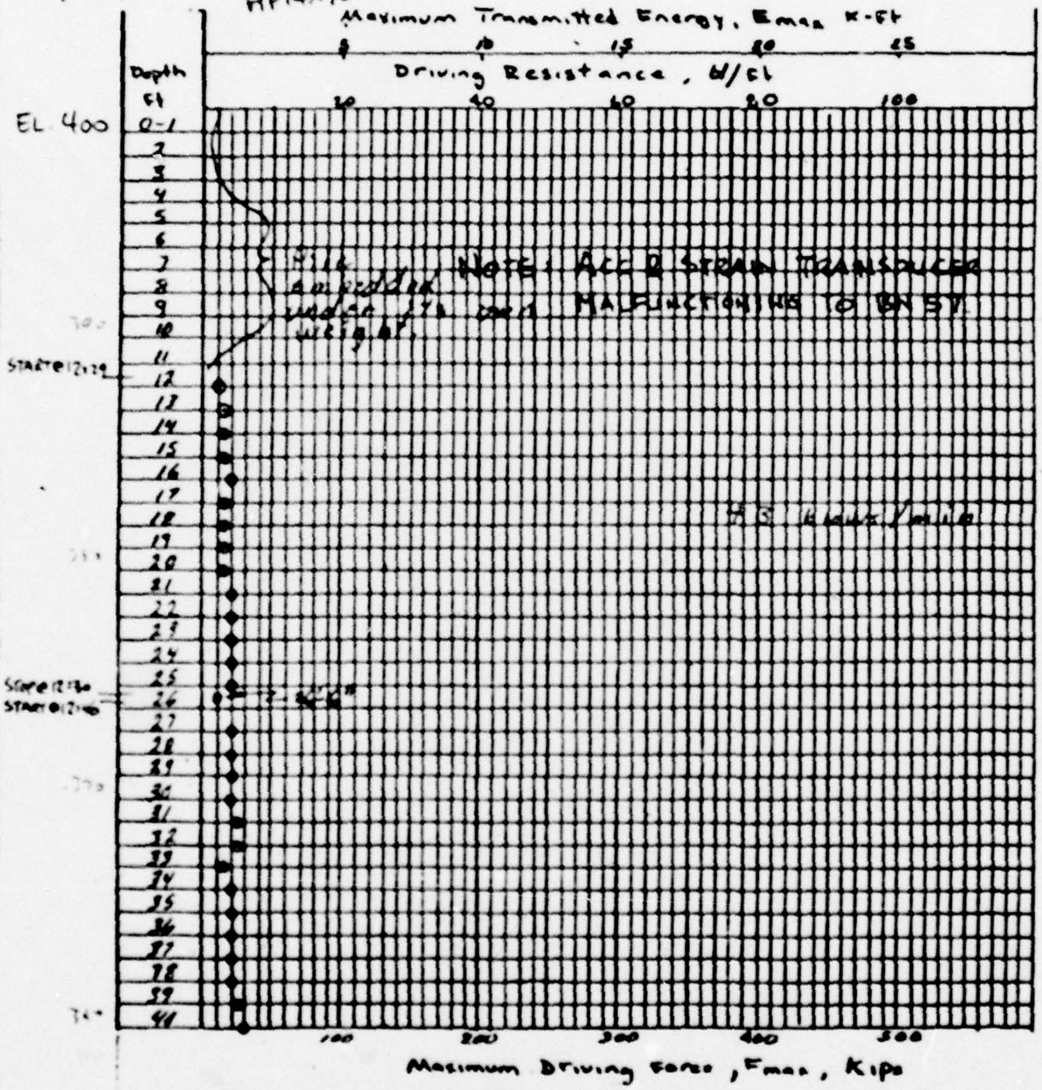
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 01 180 0 0000 (1 of 3)

Date 30 DEC 78
operator JSL

PILE DRIVING MEASUREMENTS
PILE No. 07
30 ft M1
HP14x73

	Time	Sequence No
First		
Finish		



WCC; Y7C0ES; Phase III ; VOL II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

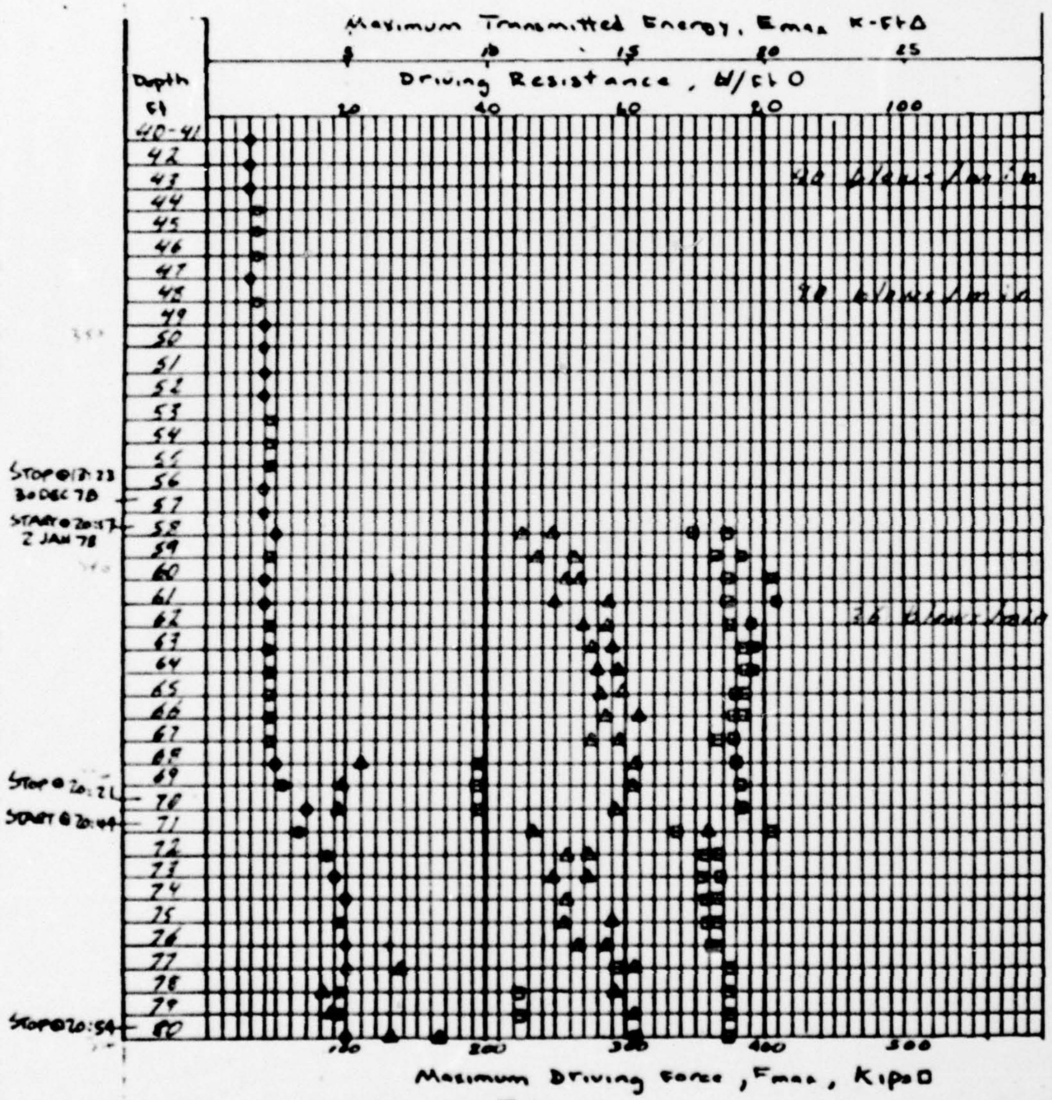
I.D. No. 09 01 180 Ø 0700 P. 2 of 3

Date ______

operator ______

PILE DRIVING MEASUREMENTS
PILE No. 07

	Time	Sequence No
First		
Finish		



WCC. 77C085 Phase IV ; VOL II A

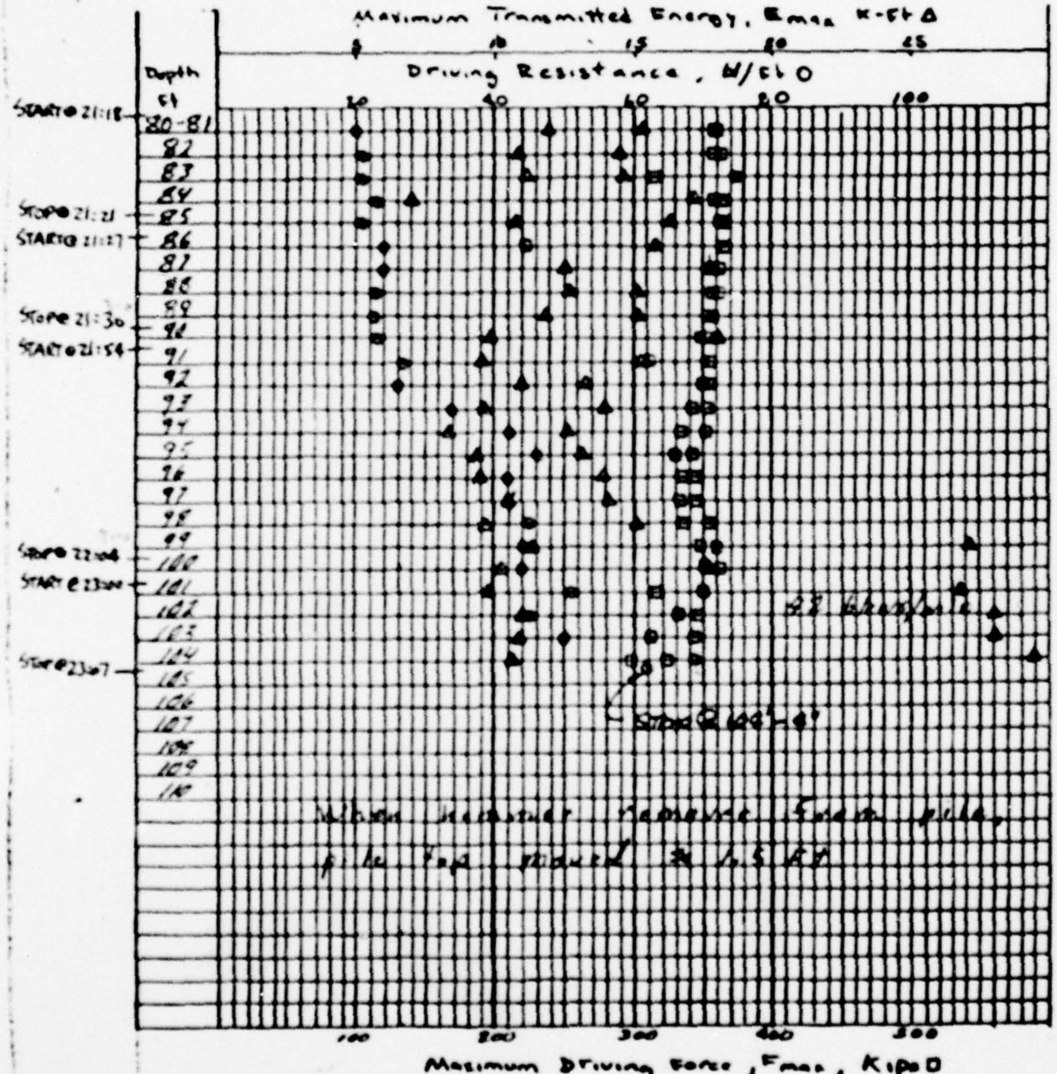
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING MEASUREMENTS
PILE No. 07

I.D. No. 09 01 180 0 0700 p. 3 of 3

Date ______
operator ______

	Time	Sequence No
First		
Finish		



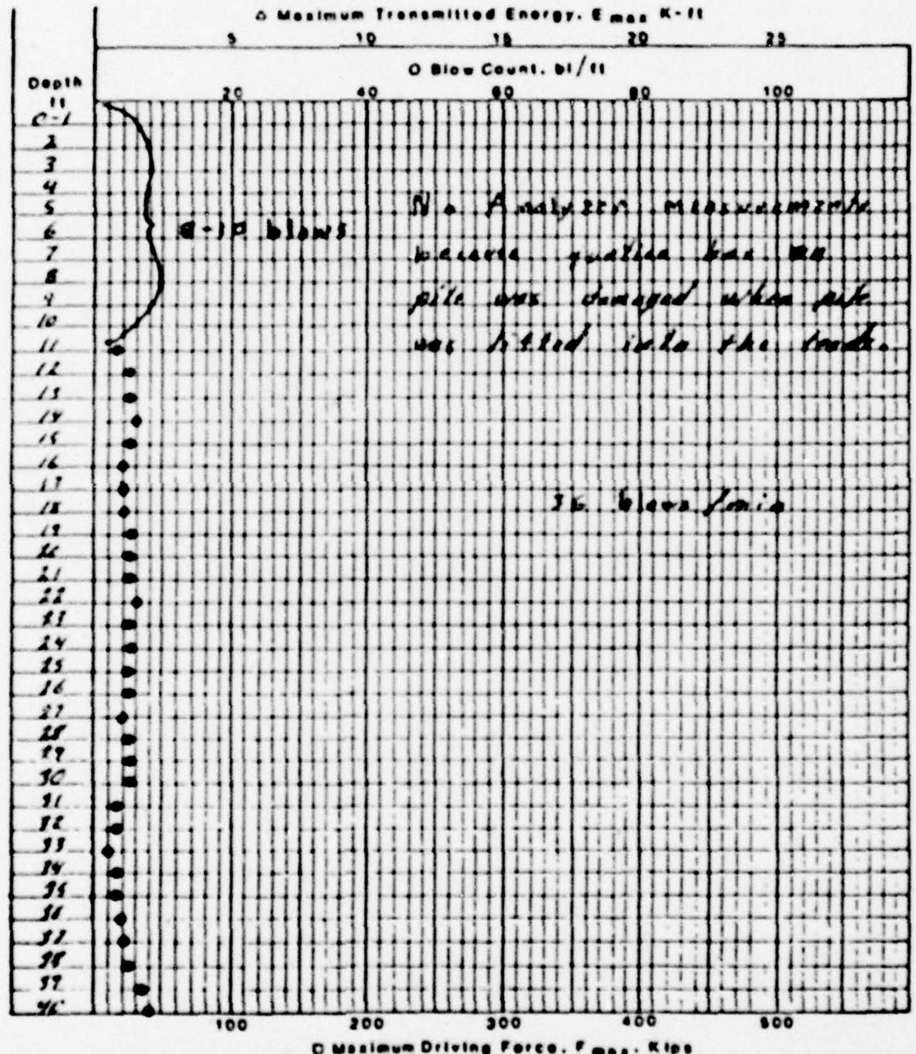
WCC, 77C0825; Phase III; Vol II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 3
I.D. No. 09 01 180 0 0800
Date 1/2/79
Operator DMW/JH

PILE DRIVING MEASUREMENTS
PILE NO. 08

	Time	Sequence No.
First		
Finish		



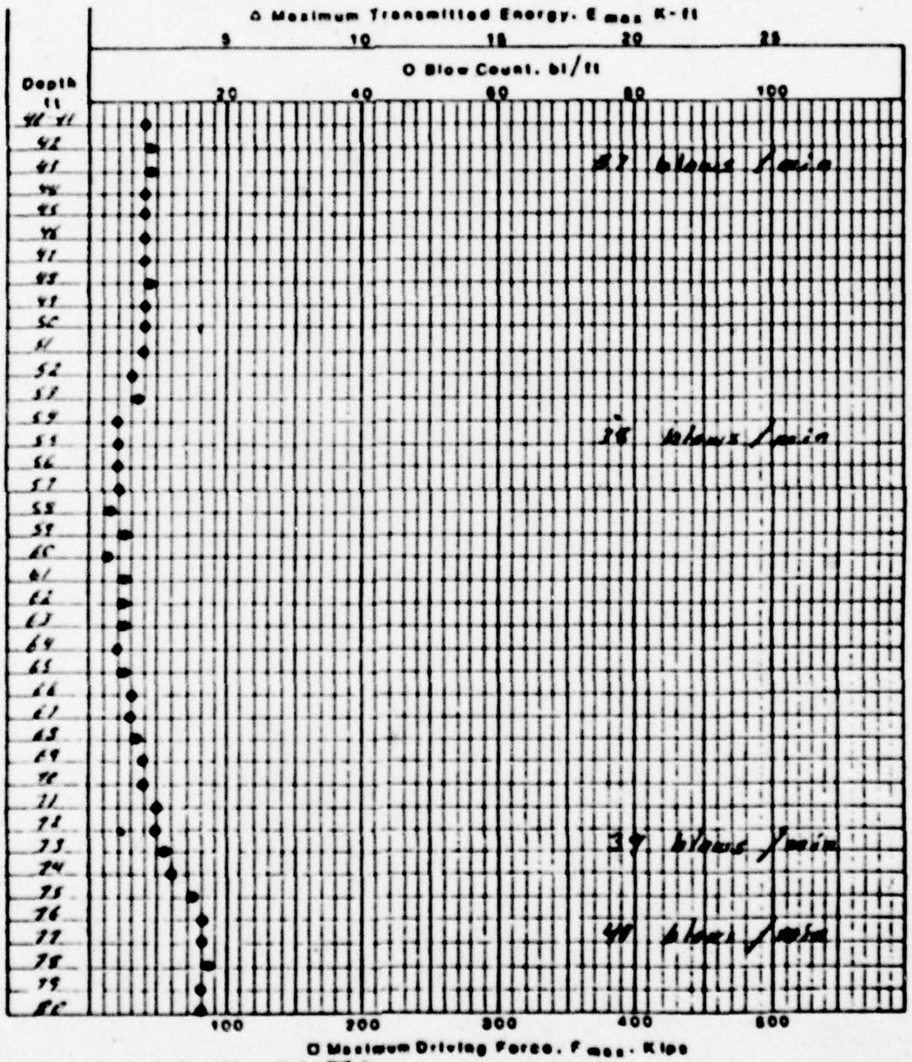
WCC. 77C825. Phase II ; VOL II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 3
I.D. No. 08 01 180 0 0800
Date 1/8/79
Operator ARS

PILE DRIVING MEASUREMENTS
PILE NO. 08

	Time	Sequence No.
First		
Finish		



WCC. Y7C625. Photo 17 ; VOL III A

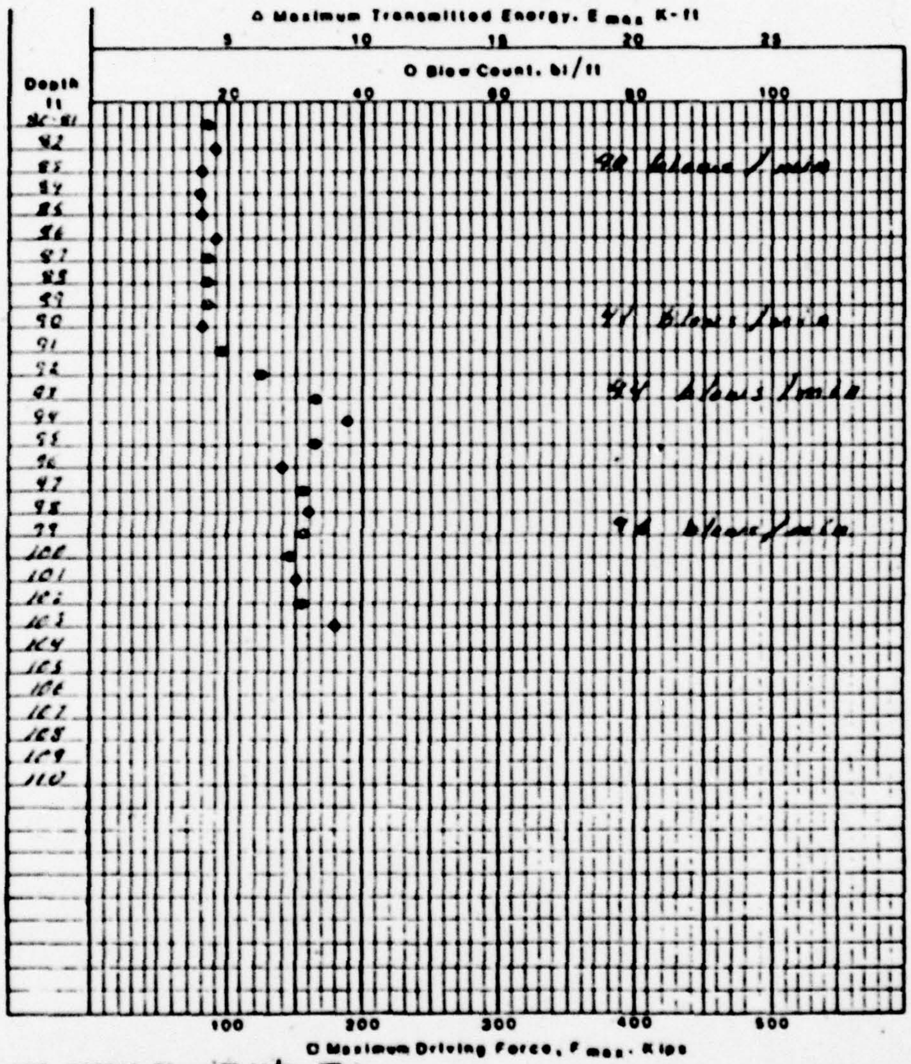
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 3 of 3
I.D. No. 09 01 160 0 0800
Date 1/3/79
Operator ACB

PILE DRIVING MEASUREMENTS

PILE NO. 08

	Time	Sequence No.
First		
Finish		



WCC. Y7C825. Phase II ; Vol. III A

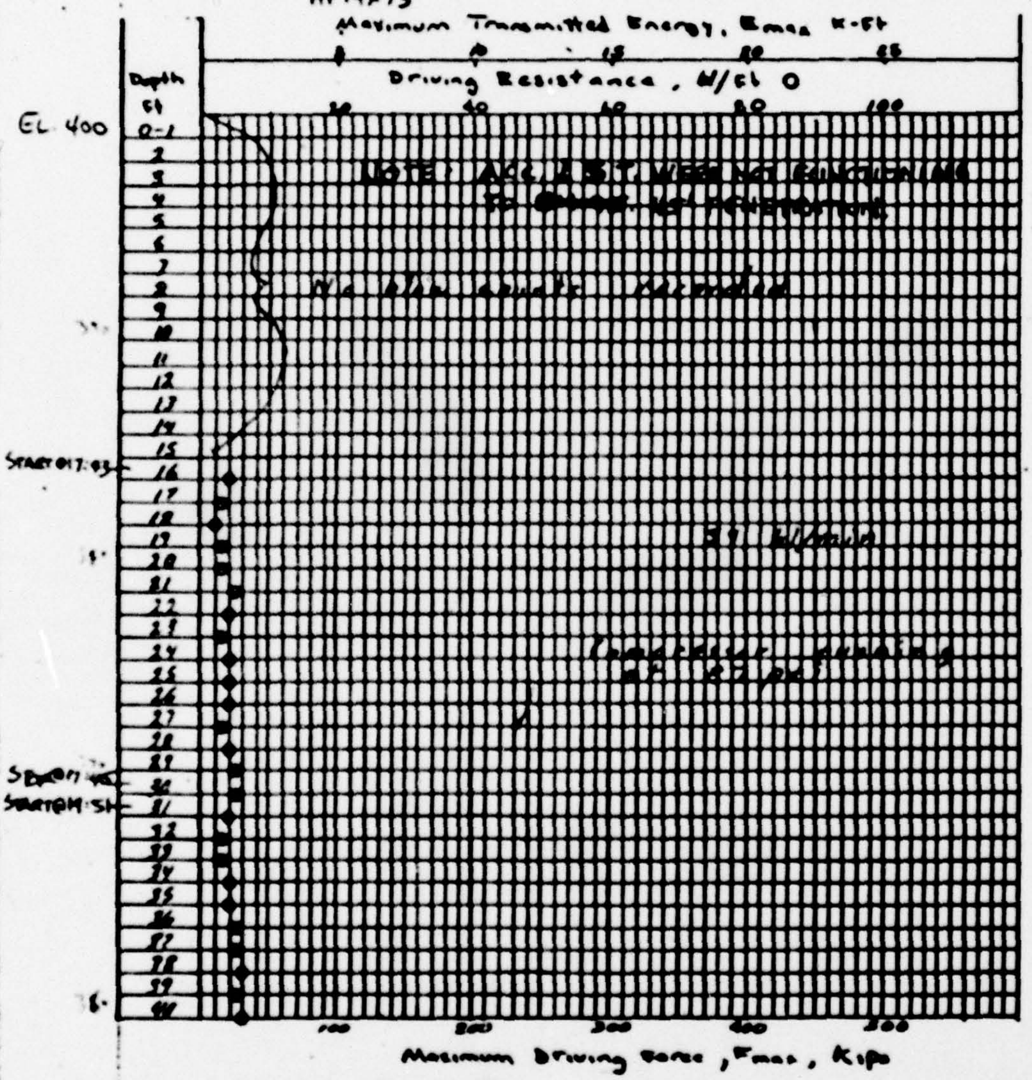
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 01 180 3 0000

Date 3 JAN 79
operator JSL

PILE DRIVING MEASUREMENTS
PILE No. 09
30' M1, Offset 3'E.
HP14x73

	Time	Sequence No
First	17:43	0901
Finish		09



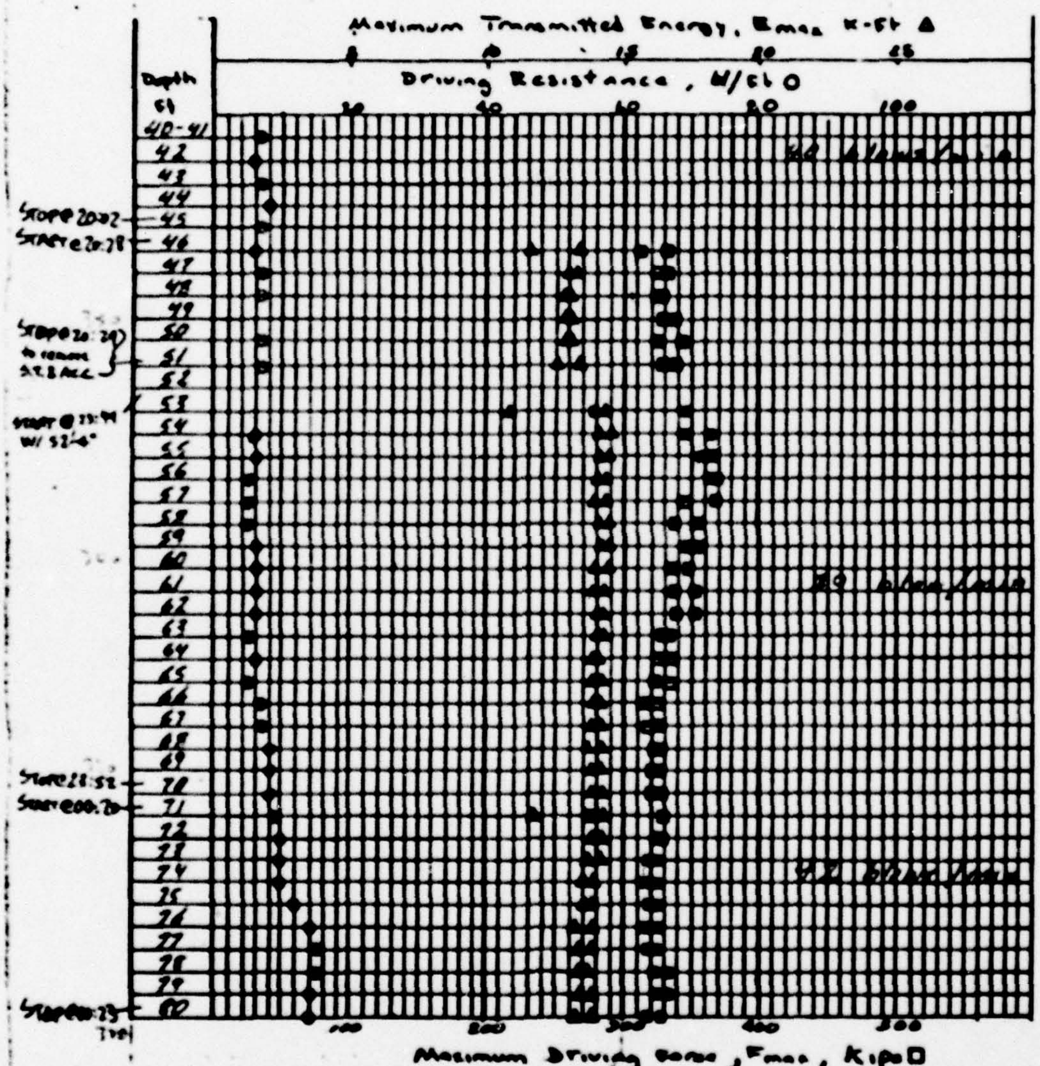
WCC, YTCBES. Phase III; Vol. II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING MEASUREMENTS
PILE No. 09

I.D. No. 09 01 180 D 0900 p. 2 of 3
Date 3 JAN 79
operator JSL

	Time	Sequence No
First		
Finish		



WCC, STCOES: Phase III ; Vol. III A

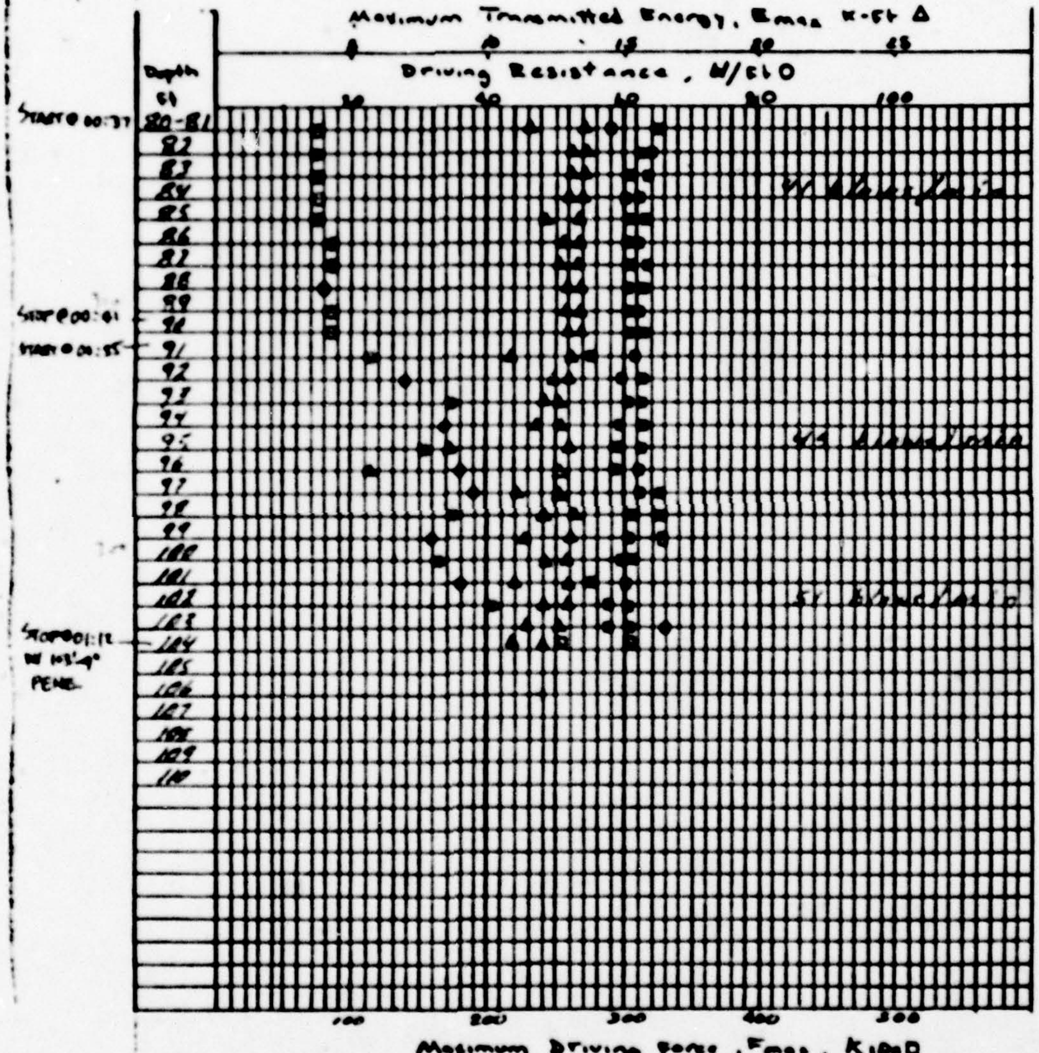
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 01 180 I 0000 P 3 of 3

Date 3 JAN 79
operator JSL

PILE DRIVING MEASUREMENTS
PILE No. 09

	Time	Sequence No
First		
Finish		



WCC, 79C085, Phase III, Vol III A

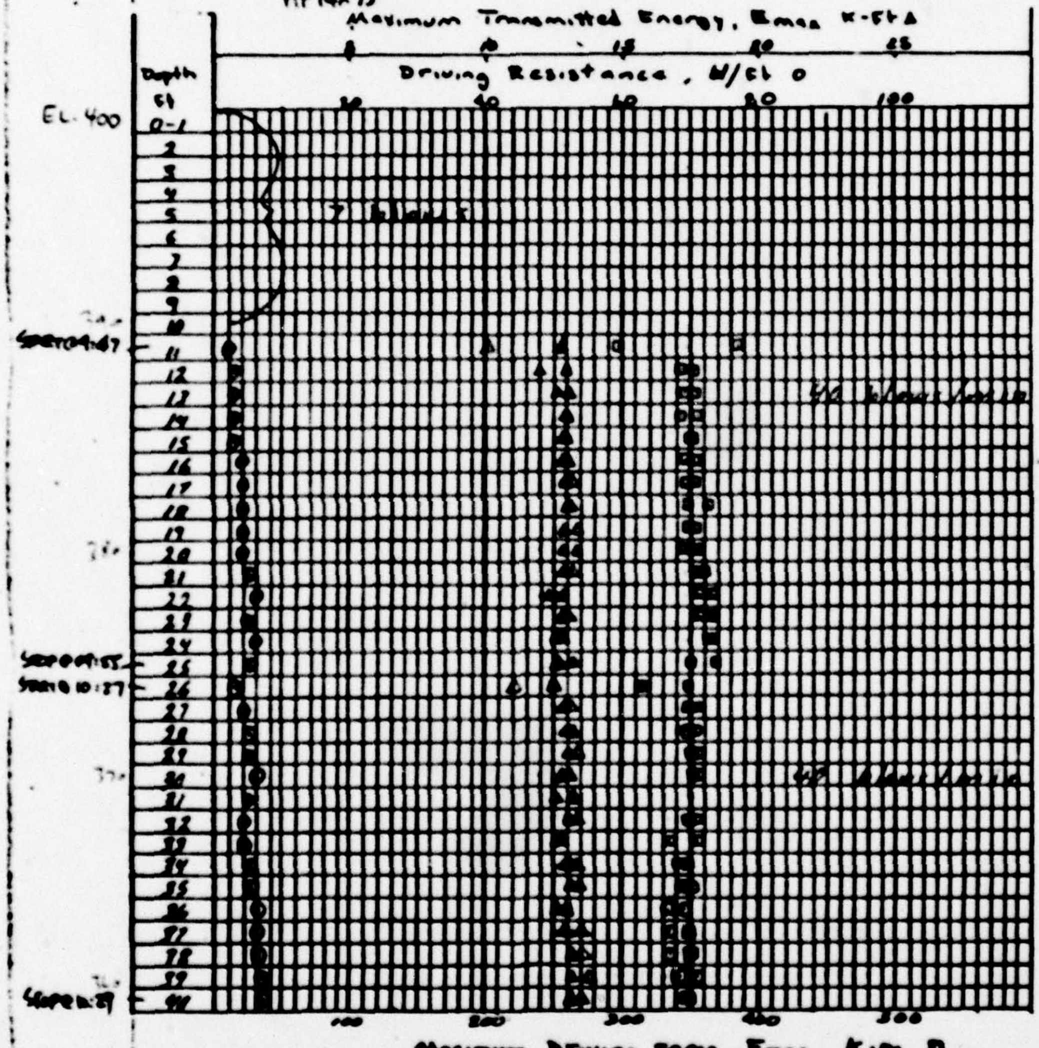
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 01 180 0 000

Date 6 Jan 1978
Operator SEK.

PILE DRIVING MEASUREMENTS
PILE No. 10
20 ft M1, 3 ft Offset W.
HP14x73

	Time	Sequence No
First	0947	1001
Finish	1649	1008



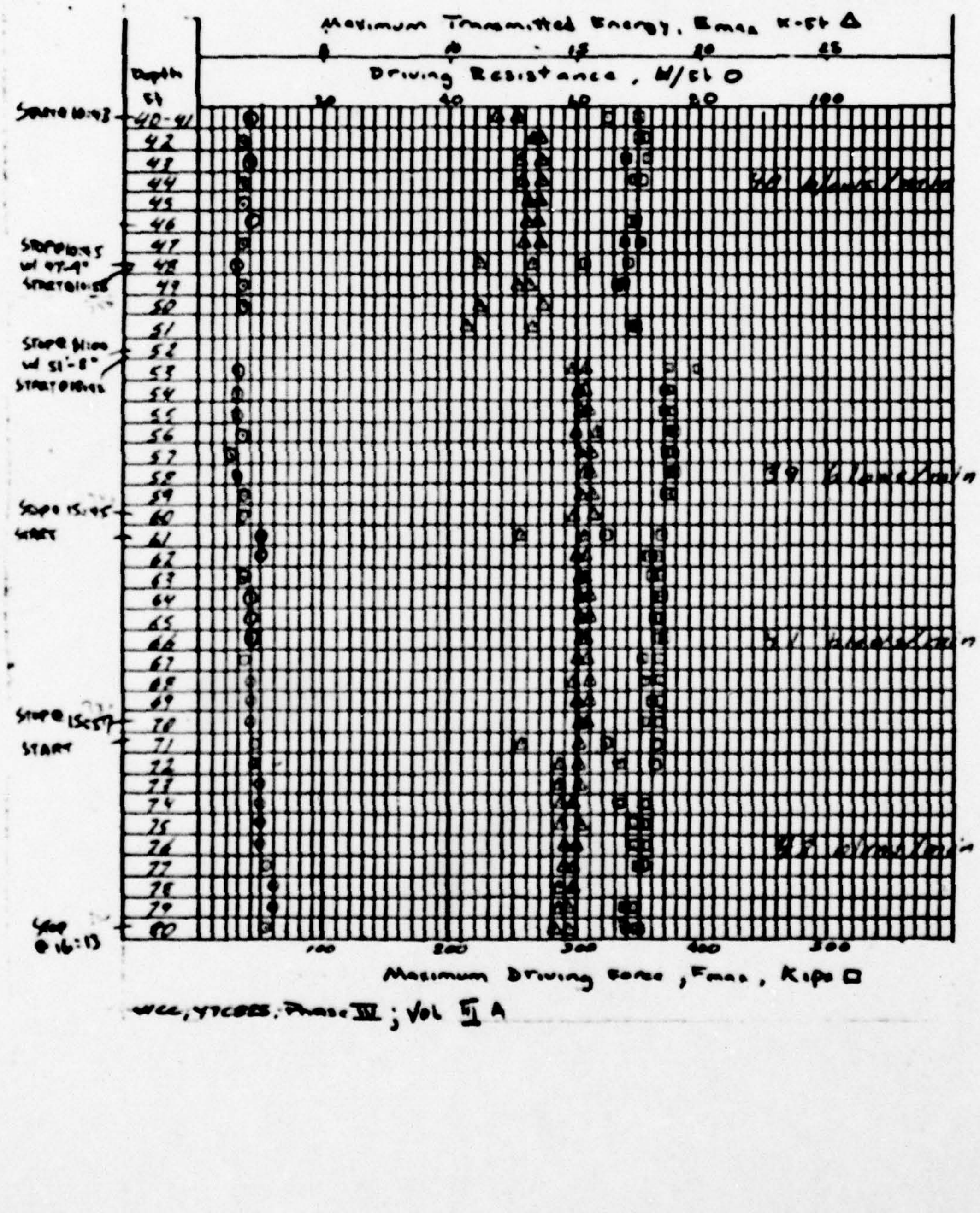
WCC 1/76055; Phase III; Vol. II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING MEASUREMENTS
PILE No. 10

I.D. No. 09 01 180 0 0000 p. 2 of 3
Date 1/4/79
operator SKK

	Time	Sequence No
First		
Finish		



WCC, YTCB83. Phase III ; Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

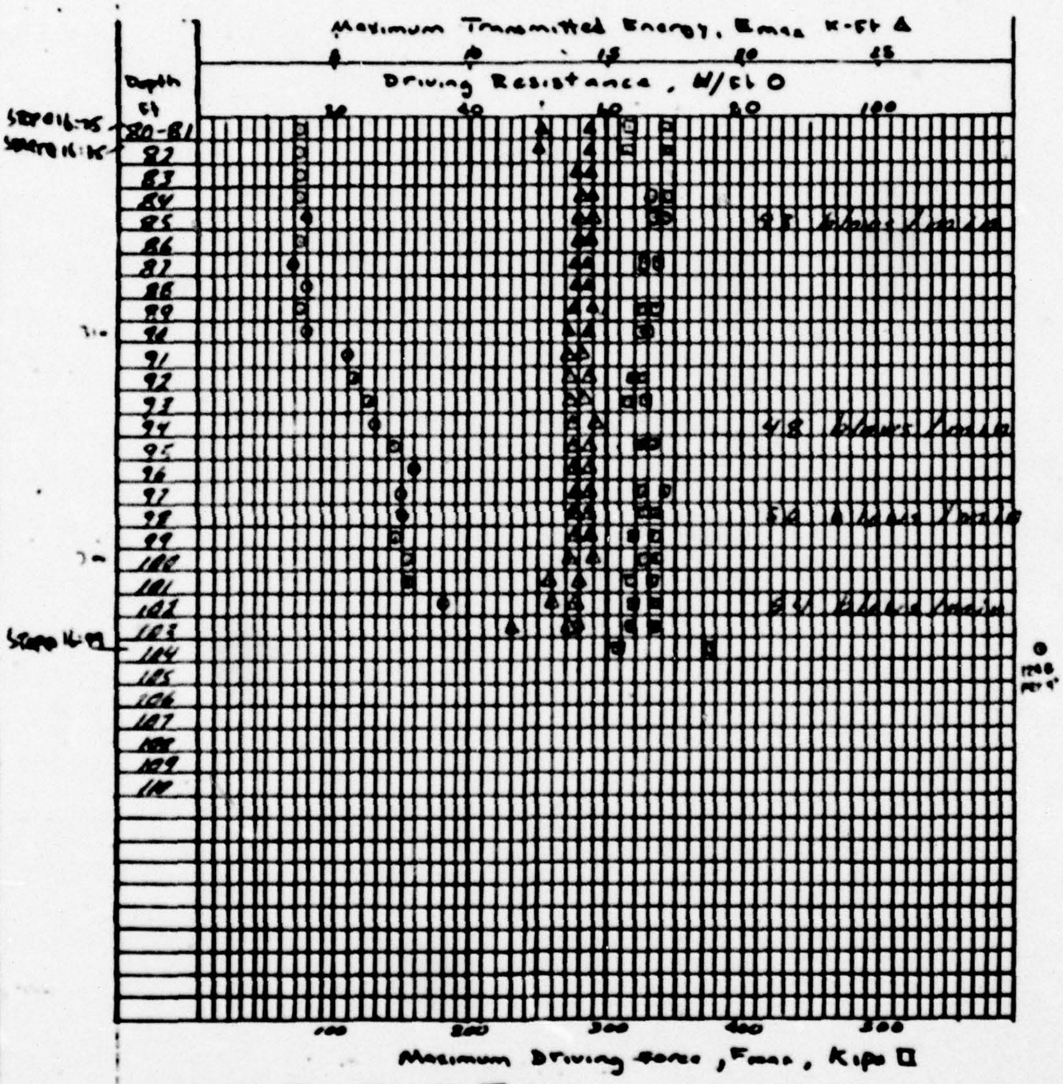
PILE DRIVING MEASUREMENTS
PILE No. 10

I.D. No. 09 01 180 D 000 (P 3 of 3)

Date 1/4/79

operator SEK

	Time	Sequence No
First		
Finish		



WES; YTC885; Phase III ; VOL III A

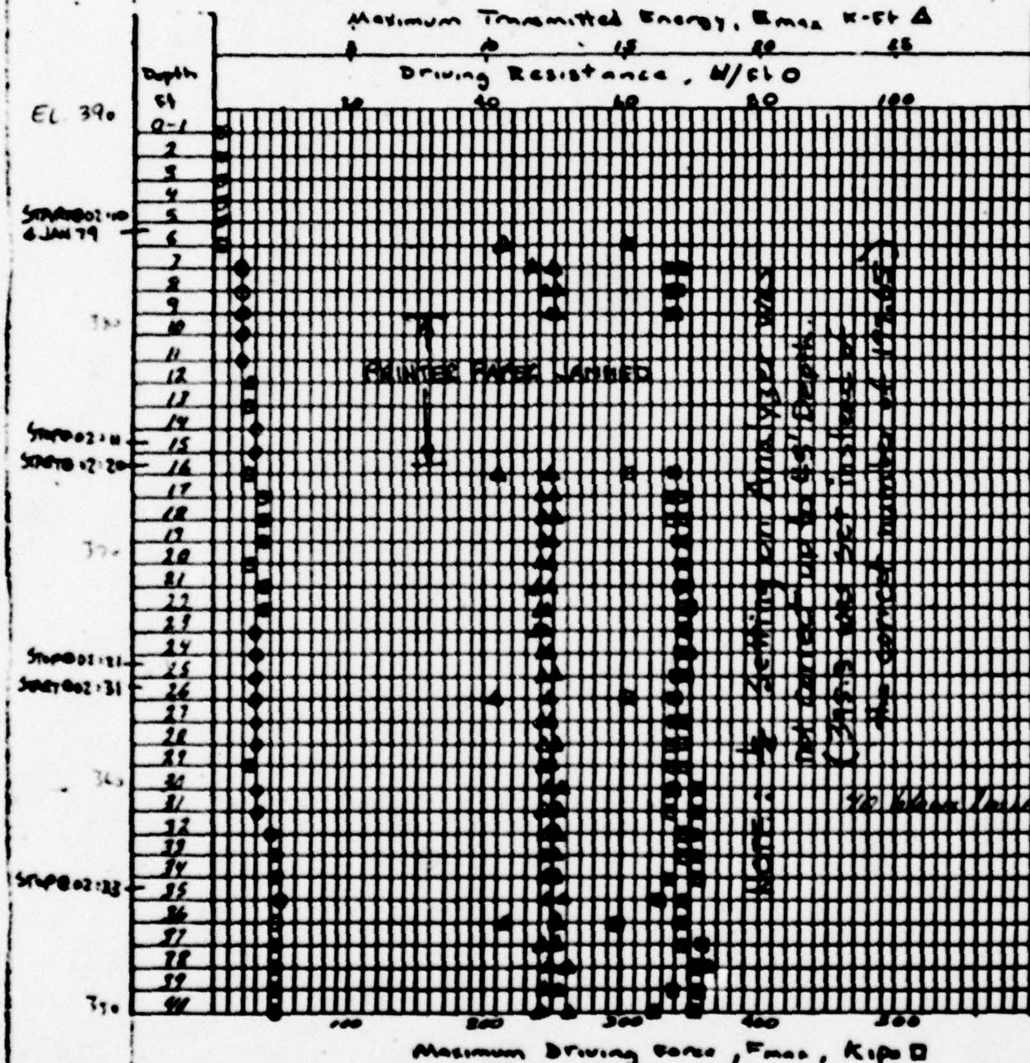
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 01 180

Date 5 JAN 79
operator JSL/SEK

PILE DRIVING MEASUREMENTS
PILE No. 11
7'-8" M1
HP14x73

	Time	Sequence No
First	02:10	1101
Finish		



WCC, YTCBES, Phase III ; VOL III A

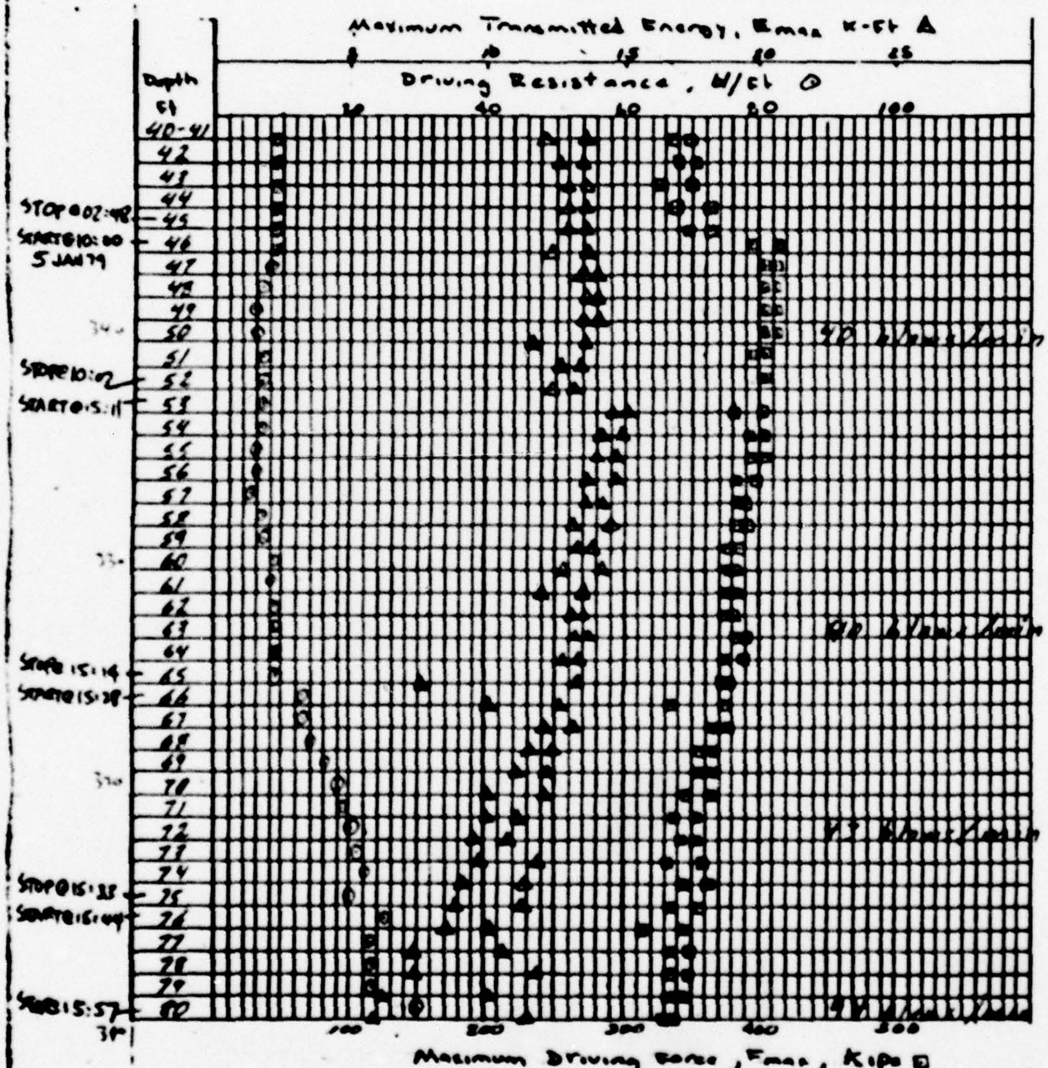
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING MEASUREMENTS
PILE No. 11

I.D. No. 09 01 180 0 0 00

Date 1/5/79
operator JSL/SFK

	Time	Sequence No
First		
Finish		



REF. ???: Phase III; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

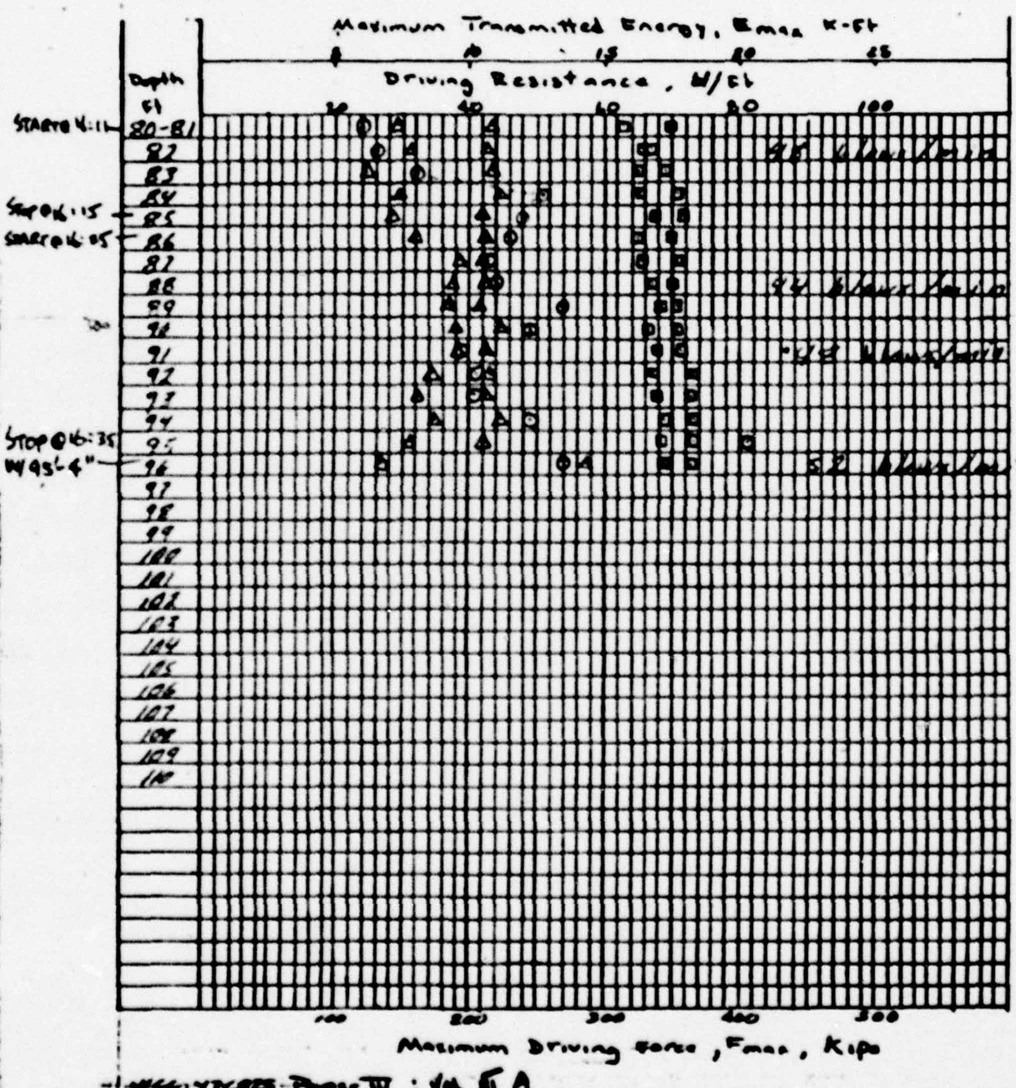
PILE DRIVING MEASUREMENTS
PILE No. 11

I.D. No. 09 01 180 I 0000

Date 1/5/79

Operator

	Time	Sequence No
First		
Finish		



Phase III ; Vol II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 01 180 0 1200

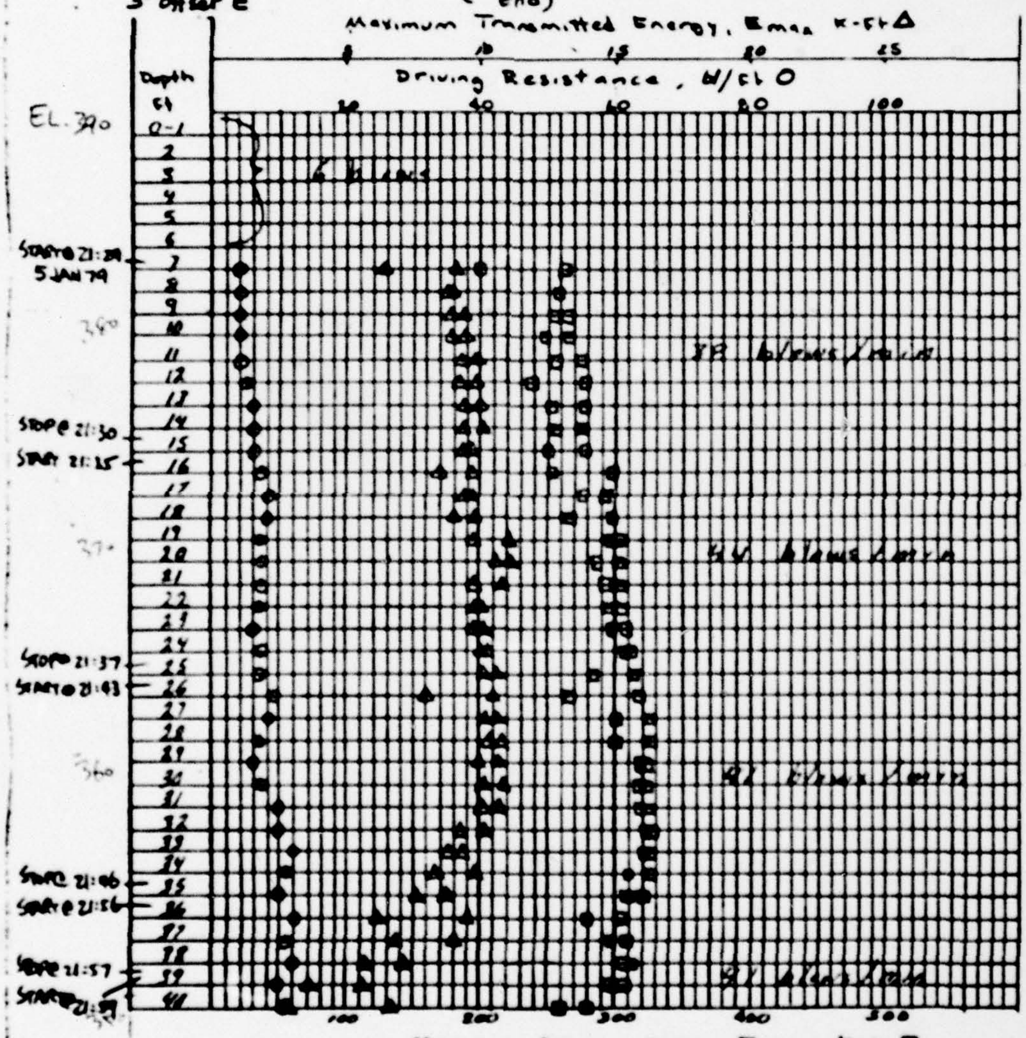
Date 5 JAN 79
operator JSL

PILE DRIVING MEASUREMENTS
PILE No. 12

	Time	Sequence No
First	21:29	1201
Finish		12

6'-8" M1
3' Offset E

PP 14Φ x .375" (Open End)



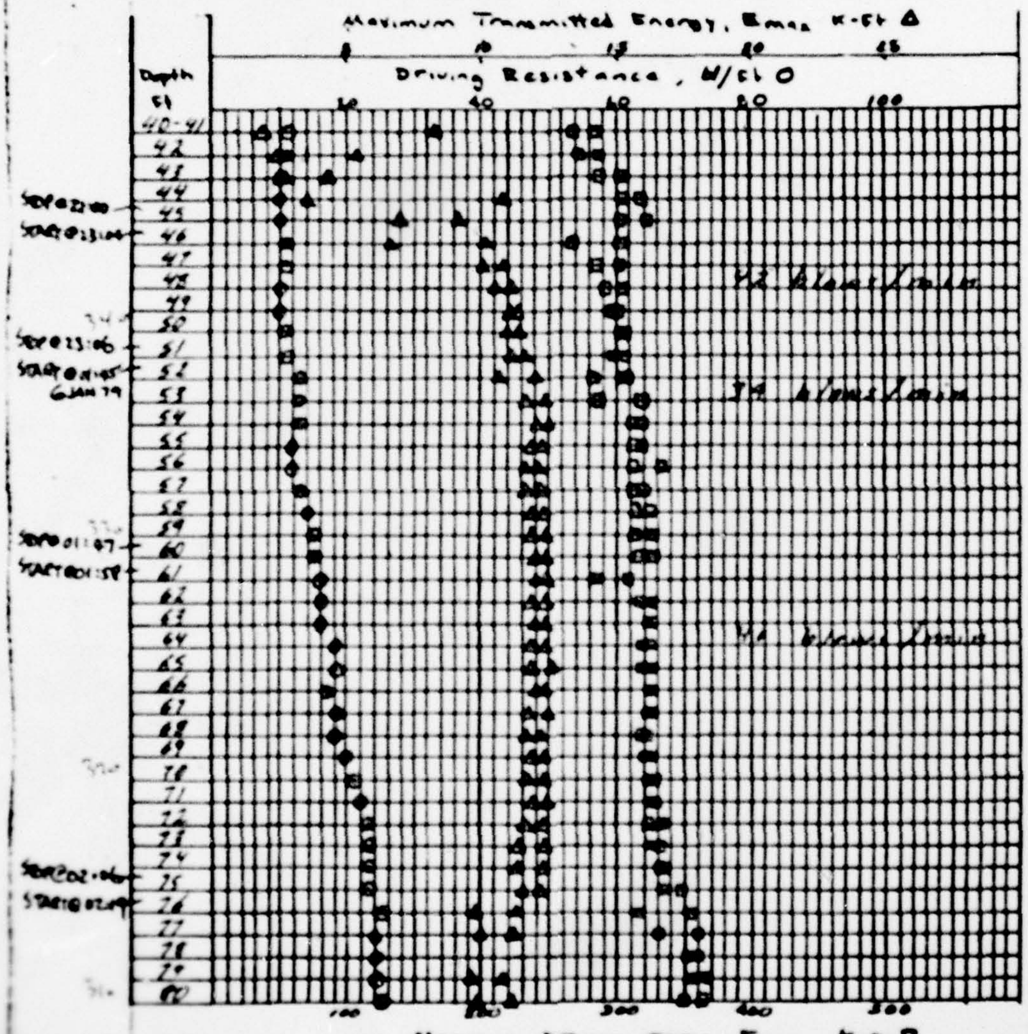
WCC, 77C083, Phase III § VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING MEASUREMENTS
PILE No. 12

I.D. No. 09 01 180 0 0 00 — P 2 of 3
Date 5 JAN 79
operator

	Time	Sequence No
First		
Finish		



WCC, 47C0825, Phase IV; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 01 180 6 0200

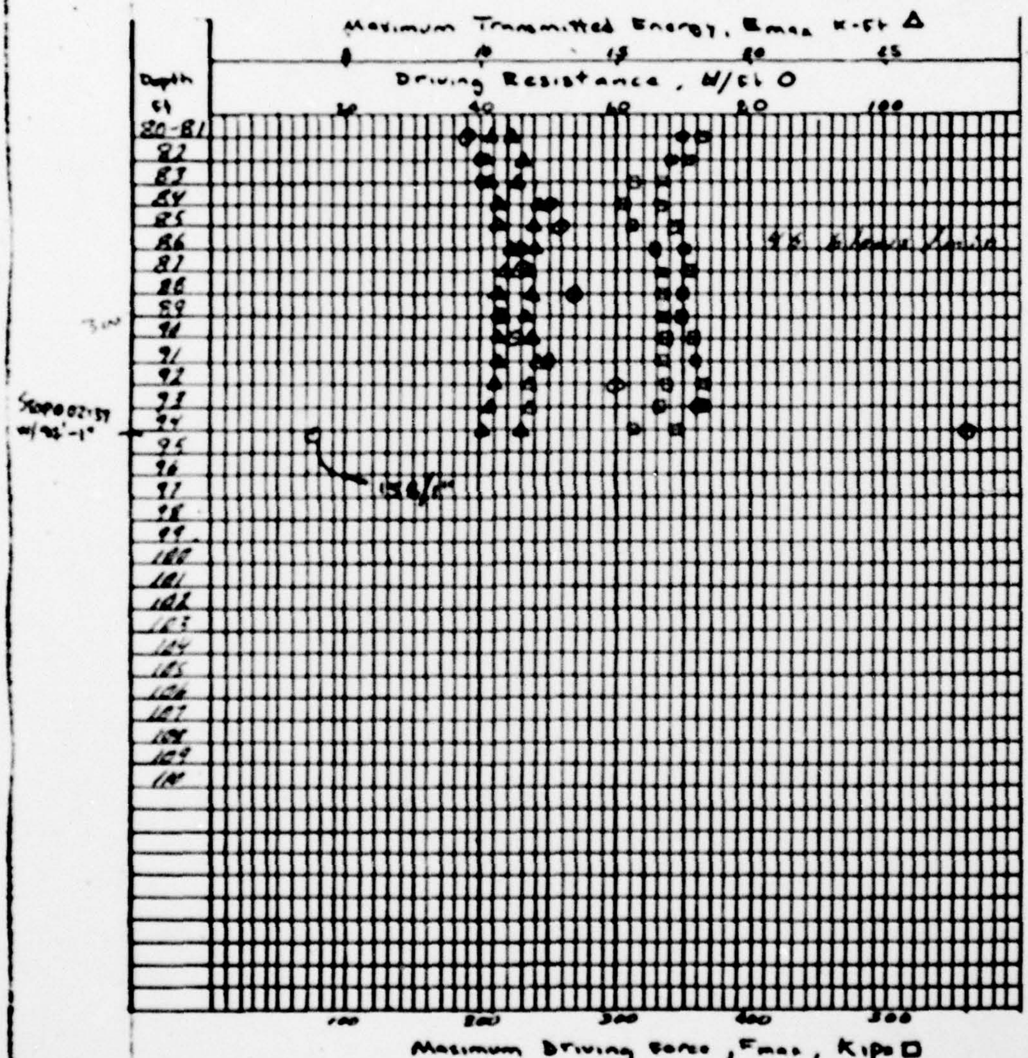
p. 2 of 3

Date 1/5/79

operator JSL

PILE DRIVING MEASUREMENTS
PILE No. 12

	Time	Sequence No
First		
Finish		



WCC, 47C083. Phase III ; Vol II A

LOCKS AND DAM NO. 26 I.D. NO. 09 01 180 0 1300

PILE DRIVING EFFECTS TEST Date 6 JAN

operator JS

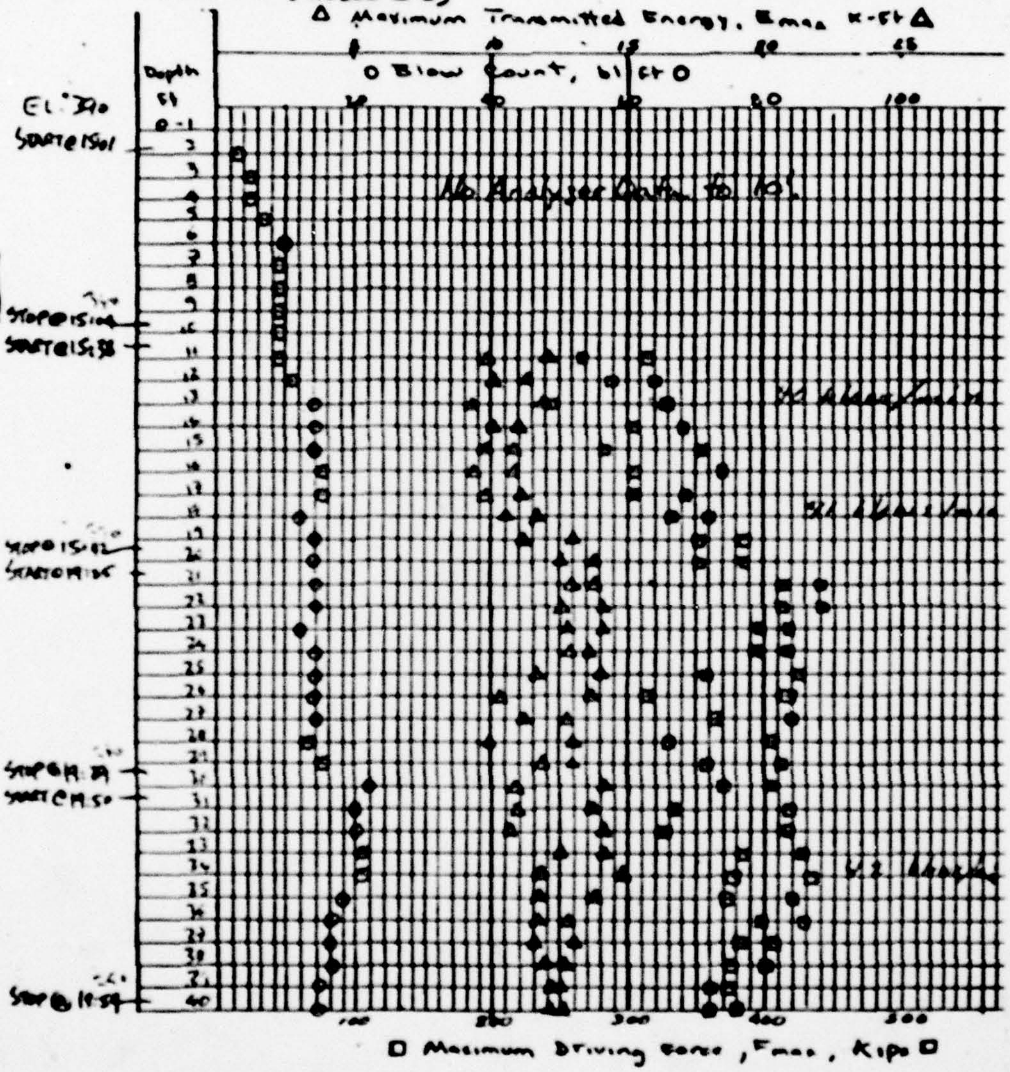
PILE DRIVING MEASUREMENTS

PILE NO. 13

6'-8" M1 3' Offset W.

PP14X.375 (Closed End)

	Time	Sequence No
First	1501 6 JAN 79	1301
Finish	01:07 7 JAN 79	1308



WCC, Y7C025. Phase III; Vol II A

LOCKS AND DAM No. 26 — I.D. No 09 01 180 0 1300

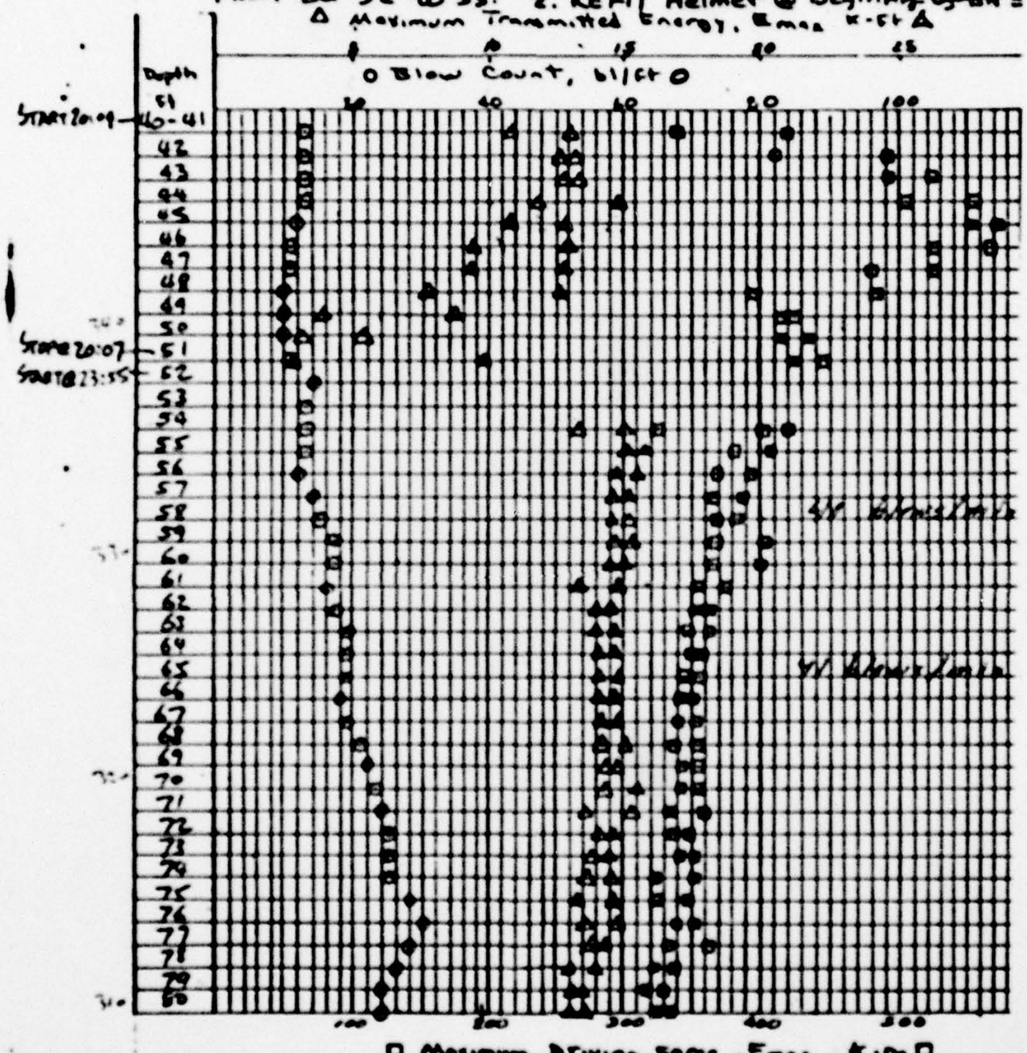
PILE DRIVING EFFECTS TEST — Date 6/6/79

operator JSL

PILE DRIVING MEASUREMENTS — Time — Sequence No

PILE No. 13 — First

NOTE: 1. ACC. & S.G. NOT FUNCTIONING Finished FROM 52' to 53'. 2. REFIT Helmet @ Beginning of ...



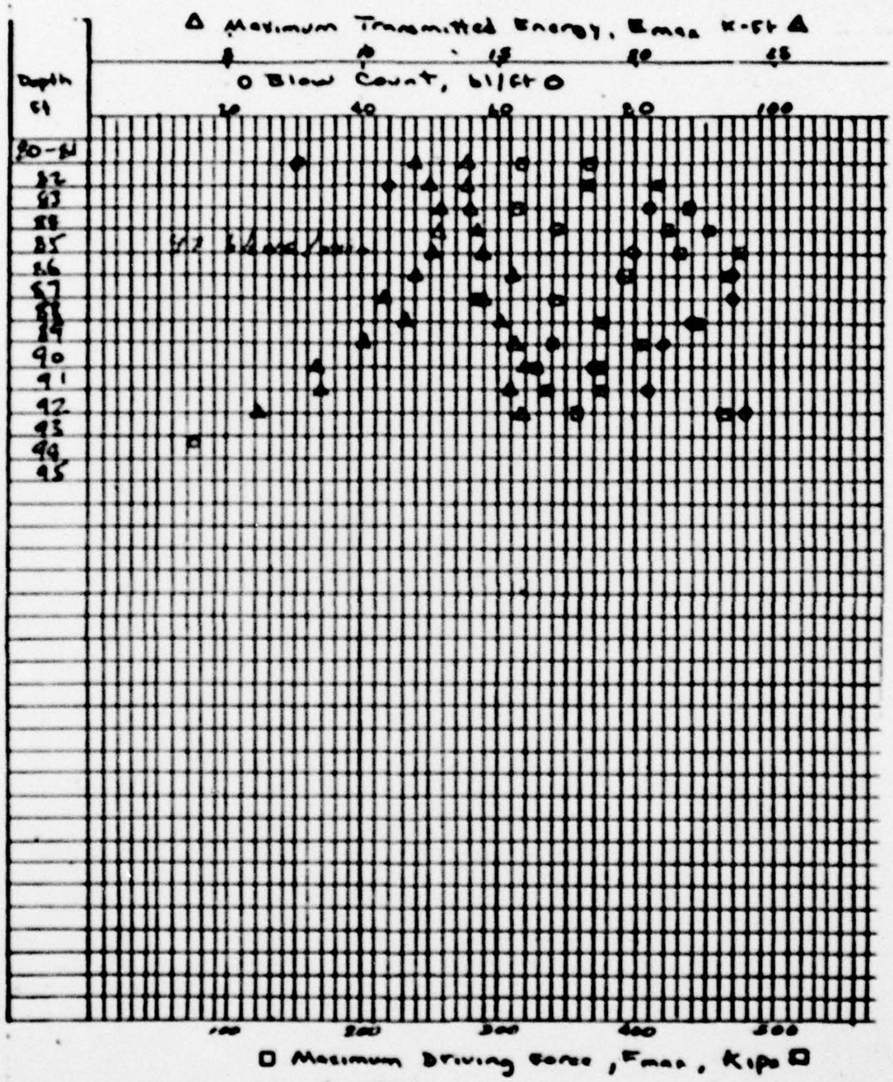
WCC, Y7C025. Phase III; VOL III A

LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING MEASUREMENTS
PILE No. 13

I.D. No 09 01 180 0 1300
Date [illegible]
operator JSL

	Time	Sequence No
First		
Finish		



WCC, YTCBES. Phase III; Vol III A

L.7 ABSOLUTE DISPLACEMENTS OF MONOLITH M1

The absolute disslacements of monolith during prototype pile driving, presented in Tables L.1a and L.1b, are with respect to the position of monolith, completely unloaded, before prototype pile driving.

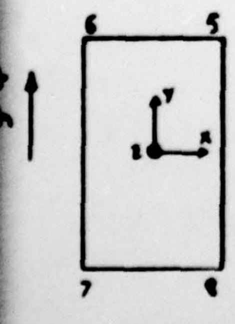
The absolute displacements of monolith, presented in Table L.2 are with respect to initial monolith position before preloading (no load applied); therefore, these displacement values represent total monolith displacements throughout the tests.

55	358.1	72.6	0.743	0.775
12/27 / 15:18			0.759	0.775
65	357.4	72.6	0.757	0.789
12/27 / 21:30			0.770	0.799
180	358.3	72.7		
12/28 / 09:12			0.784	0.810
189	359.1	72.3	0.777	0.785
12/28 / 13:47			0.783	0.811
192	358.8	72.8	0.832	0.846
12/28 / 14:32			0.827	0.848
197	358.1	72.7	0.819	0.840
12/28 / 17:02			0.835	0.857
199	357.9	72.5	0.850	0.848
12/29 / 10:29			0.841	0.862
205	358.6	72.4		
12/29 / 14:54			0.840	0.859
215	358.3	72.8	0.879	0.896
12/29 / 18:25			0.886	0.896
228	358.3	72.4	0.881	0.901
12/30 / 12:19			0.879	0.898
228	358.1	72.6		
12/30 / 13:44			0.876	0.897
235	358.8	72.4	0.899	0.877
1/02 / 19:10			0.864	0.866
248	357.9	72.7	0.935	0.933
1/02 / 01:51			0.905	0.929
474	359.6	72.9		
1/03 / 11:57			0.969	0.981
487	354.6	72.4	1.084	1.076
1/03 / 16:20			1.029	1.068

-0.255	-0.228	-0.140	-0.070	-0.105
-0.244	-0.224	-0.130	-0.094	-0.112
-0.260	-0.225	-0.160	-0.090	-0.125
-0.254	-0.253	-0.134	-0.088	-0.111
-0.260	-0.230	-0.150	-0.100	-0.125
-0.243	-0.220	-0.138	-0.106	-0.122
-0.280	-0.255	-0.160	-0.090	-0.125
-0.274	-0.258	-0.154	-0.107	-0.131
-0.290	-0.260	-0.140	-0.090	-0.115
-0.261	-0.243	-0.144	-0.105	-0.125
-0.265	-0.218	-0.150	-0.100	-0.125
-0.230	-0.204	-0.144	-0.108	-0.126
-0.265	-0.233	-0.150	-0.100	-0.125
-0.246	-0.225	-0.134	-0.104	-0.119
-0.274	-0.255	-0.131	-0.097	-0.114
-0.330	-0.295	-0.170	-0.110	-0.140
-0.309	-0.290	-0.161	-0.122	-0.141
-0.325	-0.298	-0.190	-0.110	-0.150
-0.311	-0.289	-0.187	-0.157	-0.172
-0.314	-0.296	-0.184	-0.135	-0.170
-0.340	-0.305	-0.200	-0.120	-0.160

1104	544			1.358
1/05/03:05	1/05/02:48			1.299
1105	550	363.0	73.3	1.368
1/05/11:37	1/05/14:57			1.327
1110	561	362.3	73.1	1.707
1/05/16:45	1/05/18:17			1.660
1205	598	359.5	73.6	1.789
1/05/23:00	1/06/01:43			1.724
1208	604	359.6	72.9	1.906
1/06/03:00	1/06/03:20			1.827
1300	606	360.6	73.2	1.905
1/06/07:00	1/06/15:01			1.862
1302	614	360.8	72.7	2.099
1/06/17:40	1/06/19:25			1.999
1305	622	360.1	73.2	2.207
1/06/20:30	1/06/23:39			2.102
1308	628	360.3	73.6	2.316
1/07/01:00	1/07/01:32			2.245
1309	629	361.8	72.7	2.412
1/08/00:45	1/08/00:23			2.257

Component, in.			Z-Component, in.							Remarks
7	8	Y	5	6	56	7	8	78	Z	
Optical Survey Data										
Corrected Cyber Data										
1.278	1.276	1.176								No vertical survey
1.057	1.032	1.058	-0.441	-0.496	-0.468	-0.266	-0.054	-0.175	-0.322	
1.334	1.320	1.227	-0.480	-0.510	-0.465	-0.290	-0.200	-0.245	-0.355	
1.230	1.122	1.152	-0.447	-0.512	-0.479	-0.284	-0.100	-0.192	-0.336	
1.333	1.333	1.238	-0.470	-0.550	-0.510	-0.300	-0.190	-0.245	-0.378	
1.191	1.135	1.153	-0.440	-0.513	-0.476	-0.294	-0.099	-0.196	-0.336	
			-0.460	-0.540	-0.500	-0.310	-0.220	-0.265	-0.383	No horizontal survey
1.213	1.155	1.160	-0.492	-0.557	-0.524	-0.318	-0.112	-0.215	-0.370	
1.440	1.441	1.329	-0.550	-0.600	-0.575	-0.310	-0.230	-0.270	-0.423	
1.261	1.190	1.207	-0.564	-0.617	-0.591	-0.344	-0.136	-0.240	-0.415	
1.435	1.453	1.332	-0.540	-0.615	-0.578	-0.360	-0.270	-0.315	-0.447	Load cell channels inoperable
1.278	1.223	1.233	-0.549	-0.605	-0.577	-0.360	-0.182	-0.271	-0.424	
1.612	1.614	1.488	-0.570	-0.660	-0.615	-0.360	-0.270	-0.315	-0.465	Load cell channels inoperable
1.406	1.337	1.349	-0.581	-0.644	-0.612	-0.369	-0.187	-0.278	-0.445	
1.634	1.635	1.507	-0.690	-0.730	-0.710	-0.360	-0.260	-0.310	-0.510	
1.459	1.381	1.388	-0.660	-0.714	-0.687	-0.380	-0.175	-0.277	-0.482	
2.031	2.030	1.876	-1.060	-1.145	-1.103	-0.690	-0.530	-0.610	-0.857	
1.765	1.690	1.716	-1.042	-1.097	-1.069	-0.660	-0.462	-0.561	-0.815	
2.138	2.128	1.967	-1.140	-1.215	-1.178	-0.680	-0.550	-0.615	-0.897	
1.823	1.756	1.767	-1.159	-1.228	-1.194	-0.718	-0.527	-0.623	-0.908	
2.310	2.272	2.107	-1.420	1.475	-1.448	-0.870	-0.750	-0.810	-1.129	
1.956	1.866	1.889	-1.393	-1.462	-1.428	-0.891	-0.710	-0.800	-1.114	
2.325	2.293	2.117	-1.450	-1.510	-1.480	-0.890	-0.750	-0.820	-1.150	
1.959	1.901	1.908	-1.427	-1.496	-1.462	-0.918	-0.695	-0.806	-1.134	
2.537	2.505	2.322	-1.530	-1.590	-1.560	-0.910	-0.760	-0.835	-1.198	
2.156	2.060	2.041	-1.467	-1.557	-1.512	-0.935	-0.688	-0.812	-1.162	
2.706	2.714	2.471	-1.680	-1.785	-1.733	-1.030	-0.820	-0.925	-1.329	
2.258	2.188	2.145	-1.609	-1.716	-1.663	-1.049	-0.762	-0.906	-1.284	
2.816	2.823	2.564	-2.000	-2.105	-2.053	-1.320	-1.060	-1.190	-1.622	
2.346	2.313	2.263	-1.906	-2.046	-1.976	-1.337	-1.000	-1.168	-1.572	
2.809	2.913	2.633	-2.030	-2.110	-2.070	-1.380	-1.090	-1.235	-1.653	
2.348	2.307	2.265	-1.923	-2.086	-2.005	-0.941	-1.001	-0.971	-1.488	



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2

PILE DRIVING EFFECTS TEST PROGRAM

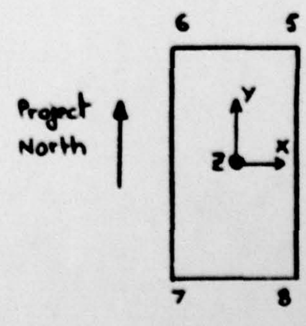
ABSOLUTE DISPLACEMENTS OF MONOLITH M1 DURING PROTOTYPE PILE DRIVING

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
[illegible]

Woodward-Clyde Consultants

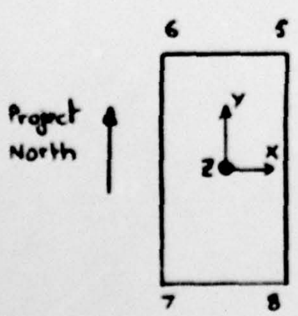
Table L.1b

Displacements	Horizontal displacement, in.					
	5	6	7	8	Average	5
	Reference point data					
	Corrected linear potentio					
at the end of preloading (monolith axially and laterally unloaded)	0.503	0.391	0.468	0.542	0.476	0.180
	0.653	0.434	0.447	0.524	0.514	0.211
prior to prototype pile driving (monolith axially and laterally loaded)	1.287	1.148	1.382	1.377	1.299	0.370
	1.418	1.186	1.185	1.260	1.262	0.412
at the end of prototype pile driving (monolith axially and laterally loaded)	2.915	2.789	3.277	3.455	3.109	2.210
	2.910	2.584	2.795	2.831	2.779	2.134
prior to load testing (monolith axially and laterally unloaded)	1.912	1.806	2.233	2.325	2.069	1.980
	2.010	1.715	1.922	1.952	1.899	1.990



ontal displacement, in.			Settlement, in.						
7	8	Average	5	6	North Average	7	8	South Average	Average
Reference point data									
0.468	0.542	0.476	0.180	0.140	0.160	0.090	0.170	0.130	0.145
0.447	0.524	0.514	0.211	0.218	0.214	0.161	0.164	0.163	0.189
1.382	1.377	1.299	0.370	0.345	0.358	0.210	0.250	0.230	0.294
1.185	1.260	1.262	0.412	0.454	0.433	0.283	0.239	0.261	0.347
3.277	3.455	3.109	2.210	2.250	2.230	1.470	1.260	1.365	1.798
2.795	2.831	2.779	2.134	2.304	2.219	1.102	1.165	1.134	1.676
2.233	2.325	2.069	1.980	2.060	2.020	1.370	1.210	1.290	1.655
1.922	1.952	1.899	1.990	2.132	2.061	1.076	1.139	1.108	1.584

Corrected linear potentiometer data



1 2

PILE DRIVING EFFECTS TEST PROGRAM

ABSOLUTE DISPLACEMENTS OF MONOLITH M1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-[illegible]

Woodward-Clyde Consultants

[illegible] Phase III ; Vol. IIA

Table L.2

Y7C-825
Phase IV ; VOL III A

L.8 INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR PROTOTYPE PILES OF MONOLITH M1

Monolith M1, Prototype Pile No. 1, Pile Type HP14x73
Final Pile Penetration 52 ft

Sequence No		01			02			03			04			05		
Pile Penetration ft		11'7"			20.0			30.0			40.0			42.0		
Junction Box Channel	Geophone No	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		V			V			V			V			V	
2	M2															
3	M3		V			V			V			V			V	
4	G14-1															
5	G12-1															
6	F3		X			X			X	X		X	X		X	X
7	F4		X	X		X	X		X	X		X	X		X	X
8	F5		X	X		X	X		X	X		X	X		X	X
9	F6			X			X			X			X			X
10	G11-1															
11	G11-15															
12	G11-50															
13	*F1		X			X			X			X			X	
14	G1-15															
15	G1-50															
16	*F2			X			X									
17	G3-15															
18	G3-50															

Monolith M1, Prototype Pile No. 2, Pile Type HP 14x73
Final Pile Penetration 105 ft

Sequence No		01			02			03			04			05			06		
Pile Penetration ft		11.5			20			30			40			50			52		
Junction Box Channel	Geophone No	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		V			V			V			V			V			V	
2	M2																		
3	M3		V			V			V			V			V			V	
4	G14-1																		
5	G13-1																		
6	F3		X	X		X	X		X	X		X	X		X	X		X	X
7	F4		X			X	X		X	X		X			X			X	
8	F5		X	X		X	X		X	X		X	X		X	X		X	X
9	F6			X			X			X			X			X			X
10	G11-1																		
11	G11-15																		
12	G11-50																		
13	*F1		X			X			X			X			X			X	
14	G1-15																		
15	G1-50																		
16	*F2												X			X			X
17	G3-15																		
18	G3-50																		

Sequence No		07			08			09			10			11			12		
Pile Penetration ft		60			70			80			90			100			105		
Junction Box Channel	Geophone No	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		V			V			V			V			V			V	
2	M2																		
3	M3		V			V			V			V			V			V	
4	G14-1																		
5	G13-1																		
6	F3		X	X		X	X		X	X		X	X		X	X		X	X
7	F4		X			X			X			X			X			X	
8	F5		X	X		X	X		X	X		X	X		X	X		X	X
9	F6			X			X			X			X			X			X
10	G11-1																		
11	G11-15																		
12	G11-50																		
13	*F1		X			X			X			X			X			X	
14	G1-15																		
15	G1-50																		
16	*F2			X			X			X			X			X			X
17	G3-15																		
18	G3-50																		

*F1 = G1-1
F2 = G3-1

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component

SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITH M1 PROTOTYPE PILES No. 1 AND 2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0000

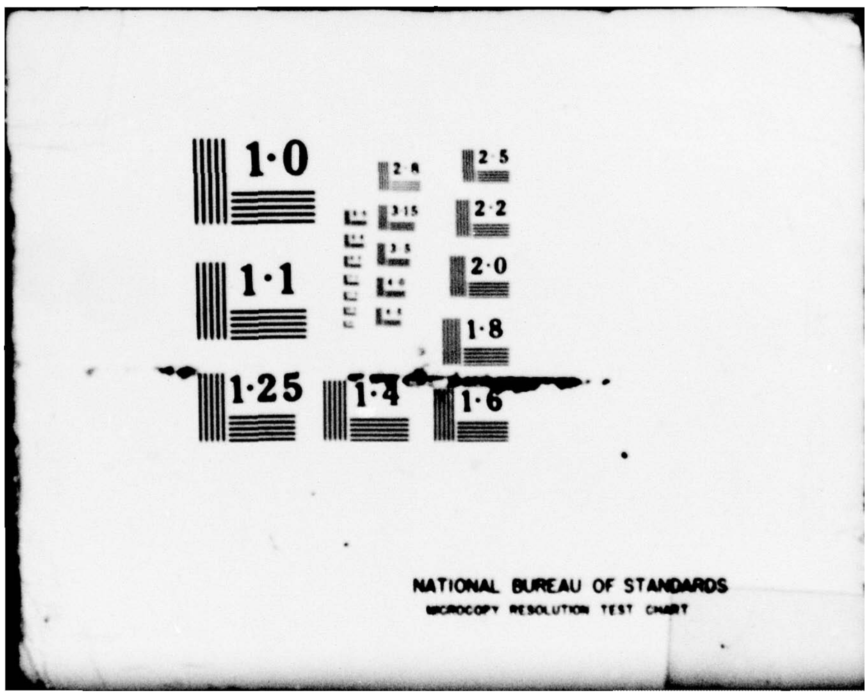
Woodward-Clyde Consultants

77C025 Phase III; Vol IIIA

AD-A076 094 WOODWARD-CLYDE CONSULTANTS CHICAGO IL F/G 13/2
RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM--ETC(U)
JUL 79 J PEREZ , D M HOLLOWAY DACW43-78-C-0005

UNCLASSIFIED NL

4 OF 6
AD-
A076094


1·0
1·1
1·25
1·4
1·6
1·8
2·0
2·2
2·5
NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

Monolith M1 Prototype Pile No. 3 Pile Type HP 14x73
Final Pile Penetration 104.75 ft

Sequence No.		03			04			05			06			07		
Pile Penetration ft		0 (13')			20			30			40			50		
Junction Box Channel	Geophone No.	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		V			V			V			V			V	
2	M2															
3	M3		V			V			V			V			V	
4	G14-1															
5	G13-1															
6	F3		X	X		X	X		X	X		X	X		X	X
7	F4		X			X			X			X			X	
8	F5		X	X		X	X		X	X		X	X		X	X
9	F6			X			X			X			X			X
10	G11-1															
11	G11-15															
12	G11-50															
13	*F1		X			X			X			X			X	
14	G1-15															
15	G1-50															
16	*F2			X			X			X			X			X
17	G3-15															
18	G3-50															

Sequence No.		08			09			10			11			12		
Pile Penetration ft		57			70			80			90			100		
Junction Box Channel	Geophone No.	Osc	Tape	PVM	Osc	Tape	PVM	Osc	Tape	PVM	Osc	Tape	PVM	Osc	Tape	PVM
1	M1		V			V			V			X	X		X	X
2	M2															
3	M3		V			V			V			V			V	
4	G14-1															
5	G13-1															
6	F3		X	X		X	X		X	X		X			X	
7	F4		X			X			X			V			V	
8	F5		X	X		X	X		X	X		X	X		X	X
9	F6			X			X			X			X			X
10	G11-1															
11	G11-15															
12	G11-50															
13	*F1		X			X			X			X			X	
14	G1-15															
15	G1-50															
16	*F2			X			X			X			X			X
17	G3-15															
18	G3-50															

Monolith M1, Prototype Pile No. 4, Pile Type HP 14x73
Final Pile Penetration 106.5 ft

Sequence No.		1			2			3			4			6			6		
Pile Penetration ft		13.0			25.0			35.0			45.0			58.0			80.0		
Junction Box Channel	Geophone No.	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		X			X			X			X			X			X	
2	M2																		
3	M3																		
4	G14-1																		
5	G13-1			X			X			X			X			X			X
6	F3																		
7	F4		X			X			X			X			X			X	
8	F5			X			X			X			X			X			X
9	F6			X			X			X			X			X			X
10	G11-1			X			X			X			X			X			X
11	G11-15																		
12	G11-50																		
13	*F1		X			X			X			X			X			X	
14	G1-15		V			V			V			V			V			V	
15	G1-50																		
16	*F2		X			X			X			X			X			X	
17	G3-15		V			V			V			V			V			V	
18	G3-50																		

*F1 = G1-1
F2 = G3-1

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

- X all 3 components
- T x component
- L y component
- V z component

SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITH M1 PROTOTYPE PILES No. 3 and 4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0000

Woodward-Clyde Consultants

77C033 Phase III; Vol. IIA

Monolith M1, Prototype Pile No. 5, Pile Type HP 14x73
Final Pile Penetration 52 ft

Sequence No.		1			2			3					
Pile Penetration ft		11			25			45			52		
Junction Box Channel	Geophone No.	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1			X			X			X			
2	M2												
3	M3												
4	G14-1												
5	G12-1			X									
6	F3												
7	F4		X			X			X				
8	F5			X			X			X			
9	F6		X			X			X				
10	G11-1			X			X			X			
11	G11-15												
12	G11-50												
13	*F1		X			X			X				
14	G1-15		V			V			V				
15	G1-50												
16	*F2		X			X			X				
17	G3-15		V			V			V				
18	G3-50												

* F1 = G1-1
F2 = G3-1

Monolith M1, Prototype Pile No. 6, Pile Type HP 14x73
Final Pile Penetration 104.1 ft

Sequence No.		1			2			3			4			5			6														
Pile Penetration ft		11			25			40			52			70			90			104'1"											
Junction Box Channel	Geophone No.	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	✓M1		X			X			X			X			X			X													
2	✓M2		L,T			L,T			L,T			L,T			L,T			L,T													
3	✓M3																														
4	✓G14-1																														
5	✓G12-1																														
6	✓F3		X			X			X			X			X			X													
7	✓F4																														
8	✓F5		X			X			X			X			X			X													
9	✓F6																														
10	✓G11-1			X			X			X			X			X			X												
11	✓G11-15																														
12	✓G11-50																														
13	✓*F1			X			X			X			X			X			X												
14	✓G1-15																														
15	✓G1-50																														
16	✓*F2			X			X			X			X			X			X												
17	✓G3-15		X			X			X			X			X			X													
18	✓G3-50																														

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

- X all 3 components
- T x component
- L y component
- V z component

SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITH M1 PROTOTYPE PILES No. 5 and 6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-[illegible]

Woodward-Clyde Consultants
[illegible] Phase III; Vol. III A

Monolith M1 Prototype Pile No. 7 Pile Type HP 14x73
Final Pile Penetration 104 ft

Sequence No.		1			2			3			5			6			Ø7			Ø7			08			09					
Pile Penetration ft		11			25			45			57			7Ø			80			85			90			100					
Junction Box Channel	Geophone No.	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X			
2	M2																														
3	M3																														
4	G14-1																														
5	G12-1																														
6	F3																														
7	F5																														
8	G11-1																														
9	G11-15																				X										
10	G11-50																				X										
11	* F1			X			X			X			X			X			X			X			X			X			
12	G1-15		X			X			X			X			X			X			X			X			X				
13	G1-50		X			X			X			X			X			X			X			X			X				
14	G2-15																														
15	G2-50																														
16	* F2			X			X			X			X			X			X			X			X			X			
17	G3-15		X			X			X			X			X			X						X			X				
18	G3-50		X			X			X			X			X			X						X			X				

* F1 = G1-1
F2 = G3-1

Monolith M1 Prototype Pile No. 8 Pile Type HP 14x73
Final Pile Penetration 103 ft

Sequence No.		0801			0802			0804			0805			0806			0807			0808			0809								
Pile Penetration ft		10			30			515			60			70			74			80			85								
Junction Box Channel	Geophone No.	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X						
2	M2																														
3	M3																														
4	G14-1																														
5	G12-1																														
6	F3																														
7	F5																														
8	G11-1																	X			X			X							
9	G11-15																														
10	G11-50																														
11	* F1			X			X			X			X			X			X			X			X						
12	G1-15		X			X			X			X			X			X			X			X							
13	G1-50		X			X			X			X			X			X			X			X							
14	G2-15																														
15	G2-50																														
16	* F2			X			X			X			X			X			X			X			X						
17	G3-15		X			X			X			X			X			X			X			X							
18	G3-50		X			X			X			X			X																

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component
SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITH M1 PROTOTYPE PILES No. 7 and 8

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0088

Woodward-Clyde Consultants
YYC020 Phase II Vol. IIIA

Monolith M1, Prototype Pile No. 9, Pile Type HP 14x73
Final Pile Penetration 104 ft

Sequence No.		0901			0902			0903			0904			0905			0906			0907											
Pile Penetration ft		10/15			30			45			52			70			80			90											
Junction Box Channel	Geophone No.	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X									
2	M2																														
3	M3																														
4	GM-1																														
5	G12-1																														
6	F3			X			X			X			X			X			X			X									
7	F5																														
8	G11-1		X			X			X			X			X			X			X										
9	G11-15																														
10	G11-50																														
11	* F1			X			X			X			X			X			X			X									
12	G1-15		X			X			X			X			X			X			X										
13	G1-50		X			X			X			X			X			X			X										
14	G2-15																														
15	G2-50																														
16	* F2			X			X			X			X			X			X			X									
17	G3-15		X			X			X			X			X			X			X										
18	G3-50																														

* F1: G1-1
F2: G3-1

Monolith M1, Prototype Pile No. 10, Pile Type HP 14x73
Final Pile Penetration 103.75 ft

Sequence No.		1001			1002			1003			1004			1005			1006			1007			1008								
Pile Penetration ft		3			25			40			47'9"			61'8"			60			70			80			103'9"					
Junction Box Channel	Geophone No.	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X		L,T	X			
2	M2																														
3	M3																														
4	GM-1																														
5	G12-1																														
6	F3			X			X			X			X			X			X			X			X			X			
7	F5																														
8	G11-1		X			X			X			X			X			X			X			X			X				
9	G11-15																														
10	G11-50																														
11	* F1			X			X			X			X			X			X			X			X			X			
12	G1-15		X			X			X			X			X			X			X			X			X				
13	G1-50		X			X			X			X			X			X			X			X			X				
14	G2-15					OFF									G12-15																
15	G2-50																														
16	* F2			X			X			X			X			X			X			X			X			X			
17	G3-15		X			X			X			X			X			X			X			X			X				
18	G3-50																														

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component

SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITH M1 PROTOTYPE PILES No. 9 and 10

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0000

Woodward-Clyde Consultants

VYC026 Phase II ; Vol III A

Monolith M1 , Prototype Pile No. 11 Pile Type HP 14x73
Final Pile Penetration 95.4 ft

Sequence No.		1101			1102			1103			1104			1105			1106			1107			1108			1109			1110		
Pile Penetration ft		5			15			25			35			45			52			65			75			80			85		
Junction Box Channel	Geophone No.	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		LT	X		LT	X		LT	X		LT	X		LT	X		LT	X		LT	X		LT	X		X	X		X	X
2	M2																										X			X	
3	M3																										X			X	
4	G14-1																														
5	G12-1																														
6	F3			X			X																								
7	F5																														
8	G11-1		X			X			X	X		X			X			X			X			X							
9	G11-15																														
10	G11-50												X			X			X			X			X			X			X
11	*F1			X			X			X			X			X			X			X			X			X			X
12	G1-15		X			X			X			X			X			X			X			X			X			X	
13	G1-50		X			X			X			X			X			X			X			X			LT			LT	
14	G2-15																														
15	G2-50																														
16	*F2			X			X			X			X			X			X			X			X			X			X
17	G3-15		X			X			X			X			X			X			X			X							
18	G3-50																														

* F1 = G1-1
F2 = G3-1

Monolith M1 , Prototype Pile No. 12 , Pile Type PP 14 x 0.375
Final Pile Penetration 94.1 ft (open-ended)

Sequence No.		1201			1202			1203			1204			1205			1206			1207			1208								
Pile Penetration ft		6			15			25			35			45			51			60			75			94'1"					
Junction Box Channel	Geophone No.	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		X			X			X			X			X			V			V			V							
2	M2		X			X			X			X			X			V			V			V							
3	M3		X			X			X			X			X																
4	G14-1																														
5	G12-1																														
6	F3																														
7	F5																														
8	G11-1		X			X			X			X			X			X			X			X							
9	G11-15																		X			X			X						
10	G11-50			X			X			X			X			X															
11	*F1		V	X		V	X		V	X		V			V			X			X			X							
12	G1-15																														
13	G1-50			X			X			X			X			X			X			X			X						
14	G2-15																		X			X			X						
15	G2-50																														
16	*F2		V	X		V	X		V	X		V	X		V	X		X			X			X							
17	G3-15																	X			X			X							
18	G3-50												X			X			X			X			X						

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component
SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITH M1 PROTOTYPE PILES No. 11 and 12

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0000

Woodward-Clyde Consultants
77C039 Phase II ; Vol II A

Monolith M1 Prototype Pile No. 13 Pile Type PP 14 x 0.375 (close-ended)
Final Pile Penetration 93 ft

Sequence No		1301			1302			1303			1304			1305		
Pile Penetration ft		1'9"			10			20			30			40		
Location for Channel	Geophone No	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		V			V			V			X			X	
2	M2		V			V			V			X			X	
3	M3											X			X	
4	G4-1															
5	G3-1															
6	F3															
7	F5															
8	G11-1		X			X			X			V			V	
9	G1-15		X			X			X							
10	G11-50															
11	F1		X			X			X			V			V	
12	G1-15															
13	G1-50			X			X			X			X			X
14	G2-15			X			X			X			X			X
15	G2-50															
16	F2			X			X			X		X			X	
17	G3-15		X			X			X				X			X
18	G3-50			X			X			X			X			X

Sequence No		1306			1307			1308								
Pile Penetration ft		51			60			70			93					
Location for Channel	Geophone No	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		V			V			V							
2	M2		V			V			V							
3	M3															
4	G4-1															
5	G3-1															
6	F3															
7	F5															
8	G11-1		X			X			X							
9	G1-15															
10	G11-50		X			X			X							
11	F1		X			X			X							
12	G1-15															
13	G1-50			X			X			X						
14	G2-15															
15	G2-50			X			X			X						
16	F2		X			X			X							
17	G3-15			X			X			X						
18	G3-50			X			X			X						

* F1 = G1-1
F2 = G3-1

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component
SA or PVM : Peak Vibration Monitor
Osc. : Oscillograph
Tape : Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM
INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITH M1 PROTOTYPE PILE No. 13

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-79-C-0000

Woodward-Clyde Consultants
WCC Phase II : VOL II A

Y7C-825
Phase IV ; Vol III A

L.9 INFORMATION DIGITIZED FROM ANALOG MAGNETIC TAPE FOR MONOLITH M1

Geophone No.	Prototype Pile No. and Depth of Digitization (ft)												
	1	2	3	4	5	6	7	8	9	10	11	12	13
F1 = G1-1				15,48, 90	15,46								70
G1-15							30,45	30,45, 60,103			20,35, 50,70		
G1-50							30,45	30,45, 60,103			20,35, 50,70		
F2 = G3-1				15,48, 90	15,46							51,70	35,50, 70
G3-15						30,45, 60	30,45	60		30,45, 60	20,35 50,70	51,70	20
G3-50							30,45	60					
F3			15,80										
F4	15		15,80	15,90									
F5	15		15,80										
MG1											90	20,35, 50	35,50
MG2											90	20,35, 50	35,50
MG3											90	20,35, 50	35,50

Depth of Digitization is the prototype pile tip depth at which the digitized data recorded during the tests on analog magnetic tape, were processed through a computer.

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION DIGITIZED FROM ANALOG MAGNETIC TAPE FOR MONOLITH M1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0000

Woodward-Clyde Consultants

77C033 Phase III ; Vol. IV A

PHASE IV REPORT

VOLUME IIIA

RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM

APPENDIX M

MEASUREMENT DETAILS
MONOLITH M2

TABLE OF CONTENTS

Y7C-825
Phase IV ; Vol III A

M MEASUREMENT DETAILS, MONOLITH M2

M.1 COMPLETE FIELD LOGS OF INSTALLATION OF TIMBER PILES UNDER MONOLITH M2

The identification number (Id. No.) at the top right-hand corner of each data sheet includes the timber pile number shown in Fig. 5.2, Volume III.

The timber pile number is given by the two digits preceeding the last two zeros of the Id. No. (for example, page M-2 corresponds to timber pile No. 14)

The field logs are presented in chronological order of timber pile installation.

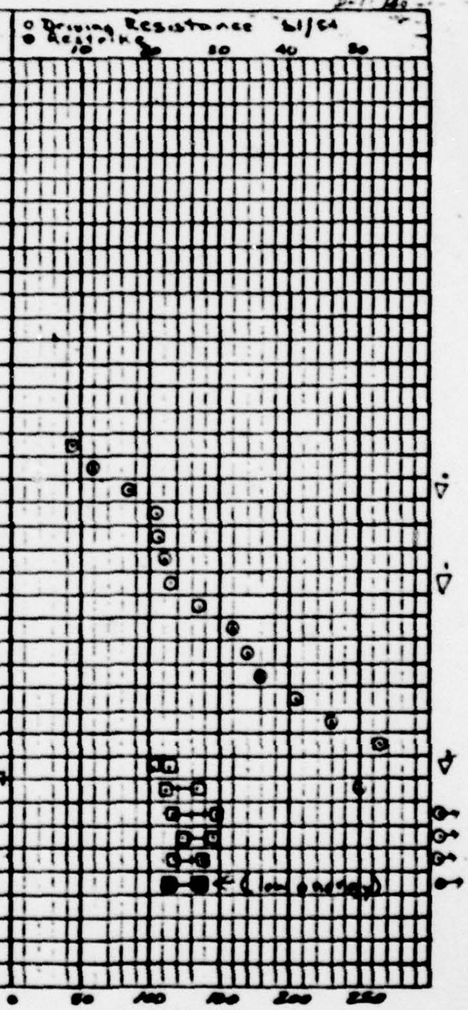
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 02 T6D 1 1400

Pile Type: Douglas Fir — Hammer: Vulcan VI — Date: 10/21/78
Pile length: 41.5' — Energy: 15,000 ft lbs — Time: 10:25 – 13:10
Ground el.: Trench level — Operating Rate: 60 blows/min — Inspector: [illegible] / D.T. [illegible]

Depth ft	Blows	Remarks
0-1		
2		Pre-drilled to 19'
3		Pile [illegible] to 16'
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17	9	
18	12	
19	17	
20	21	
21	21	
22	22	
23	23	
24	27	57 blows/min
25	32	59 blows/min
26	34	
27	36	60 blows/min
28	41	
29	46	60 blows/min
30	53	
31	37 for 10"	Analyzer, Jetting, [illegible]
32	50	
33	67	59 blows/min
34	82	
35	48 for 9"	
	57 for 6"	Restrike on 10/25/78 at 23:33 hrs



Dynamic Measurements Yes

Sequence No.	Depth ft
01 (PDA)	30 - 34.75
02 (Restrike)	34.75 to 35.25

Notes:
Pile batter at E.O.D.
0.7% S
0.8% E

○ Capacity, kips
■ Restrike
▽ Jetting

[illegible signature]
10 Oct '78

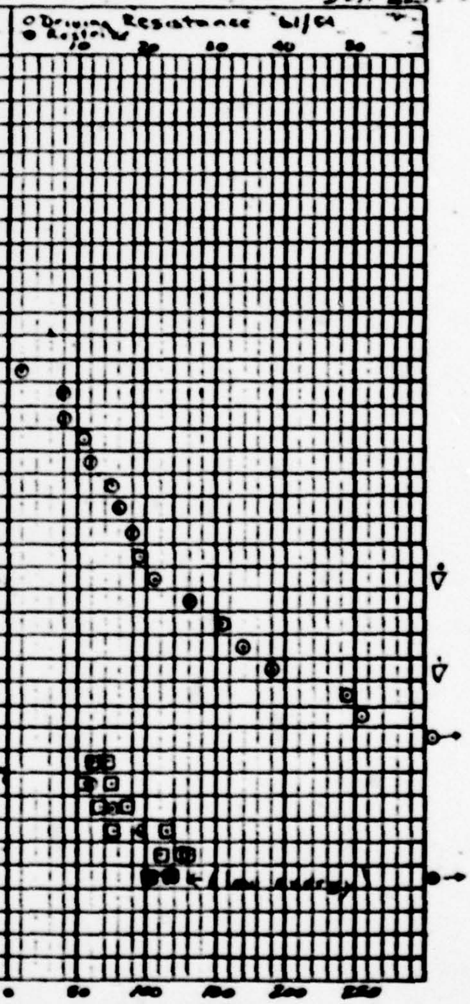
WCC, 77C0825, Phase II Vol IIA

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 03 02 160 1 3000

Pile Type [illegible] Fir | Hammer Vulcan V1 | Date 10/21/78
Pile length 42.00 | Energy 15,000 ft-lbs | Time 13.40 – 14.40
Ground el. [illegible] | Operating Rate 60 blows/min | Inspector – [illegible] D.T. [illegible]

Depth ft	Blows	Remarks
0-1		
2		[illegible] 23' [illegible]
3		[illegible] to 13 [illegible]
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14	2	
15	8	[illegible] water 15 – 20'
16	8	[illegible] (3'0) [illegible]
17	11	
18	12	
19	15	
20	16	
21	18	2-4 [illegible] water
22	19	52 blows/min
23	21	lots of [illegible] water
24	26	54 blows/min
25	31	[illegible]
26	34	55 blows/min
27	38	57 blows/min
28	49	57 blows/min
29	51	
30	65	
31	[illegible]	Analyzer – Jetting [illegible]
32	12	
33	15	
34	19	
35	25	
	70 for 6"	Restrike on 10/25/78 at 23.21 hrs



□ Capacity, kips
● Restrike
▽ Jetting

Dynamic Measurements [illegible]

Sequence No.	Depth ft
01 (PDA)	30 - 34.5
02 (Restrike)	34.5 - 35

Notes:
Pile bottom at [illegible]
2.9% S
1.0% W

WCC, 77C025, Phase II
Vol IIIA

✓ [illegible]
[illegible]

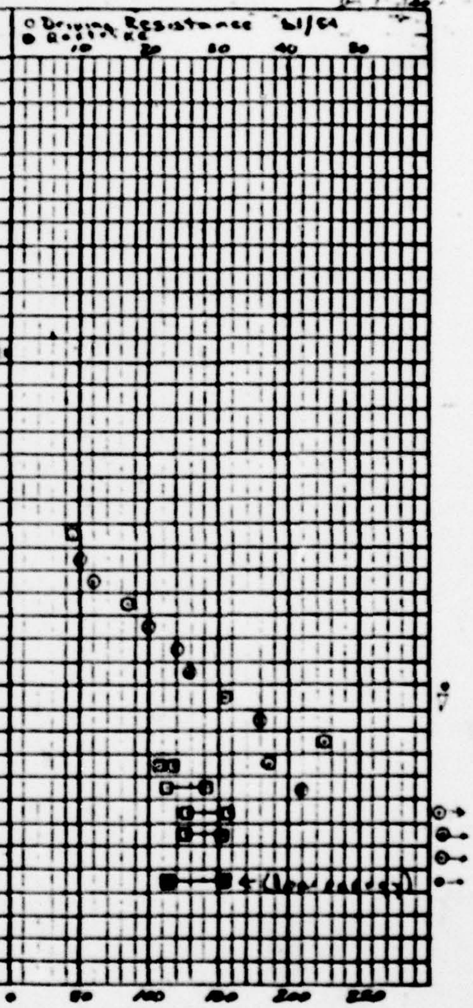
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 02 160 1 0900

Pile Type	Douglas Fir	Hammer	Vulcan VI	Date	10/21/78
Pile length	42.10	Energy	15,000 ft-lbs	Time	15 30 90
Ground el.	Tremie level	Operating Rate	60 blows/min	Inspector	[illegible]

Depth ft	Blows	Remarks
0-1		
2		Pre-drilled to 28'
3		Pile moves to 19'
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		[illegible] and wood w/ [illegible]
14		from 13' - 23'
15		Lost circulation
16		
17		Br. wood fragment 2.0'
18		[illegible] w/ return water
19	7	
20		Lost circulation
21	9	
22	10	
23	12	
24	17	
25	20	
26	24	
27	26	59 blows/min
28	31	59 blows/min
29	36	
30	45	
31	37	Pulled
32	42	
33	62	
34	69	
35	23 for 6"	
	99 for 6"	Restrike on 10/26/78 at 00 03 hrs



Dynamic measurements

Sequence No.	Depth ft
01 (PDA)	30 - 34.3
02 (Restrike)	34.3 - 34.8

Notes:
pile batter at c.o.d.
1.4% S
0.0% W

○ Capacity, kips
■ Restrike
▽ Jetting

WCC, 77C835, Phase V
Vol II A

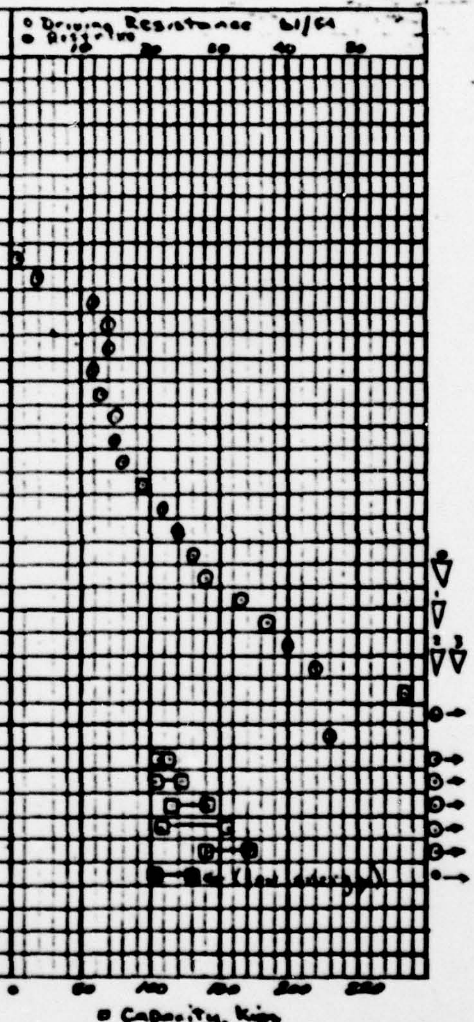
[illegible]
[illegible]'78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. U3 02 160 1 1700

Pile Type Douglas Fir | Hammer Vulcan VI | Date 21 Oct 1978
Pile length 42' | Energy 15000 ft lbs | Time 17:45
Ground el. Trench level | Operating Rate 60 blows/min | Inspector - Bob Green

Depth ft	Blows	Remarks
0-1		
2		
3		Pre-jetting to 23'.
4		Hard layer at 23' that
5		was considerable to get
6		through.
7		Pile Run to 8'
8	0	
9	1	
10	6	
11	12	
12	16	
13	16	56 blows/min
14	12	
15	13	
16	15	
17	15	
18	16	
19	19	
20	22	
21	26	
22	26	
23	28	
24	33	
25	37	58 blows/min
26	60	
27	64	
28	57	
29	73	Jetting, jet to 25'
30	66	again 30'
31	61	
32	73	Jetting, jet at 27'
33	76	
34	114	Jetting, jet at 27'
35	25 for 3"	
	100 for 1"	Redrive on 10/25/78
		at 23:05 hrs



Dynamic measurements Yes

Sequence No.	Depth ft
01 (T20)	29 - 30' 3"
11 (W&D)	30'3" - 30'9"

Notes:
Pile batter at E.O.D.
3.6% S
1.5% E

WCC, 77C025, Phase II
Vol IIIA

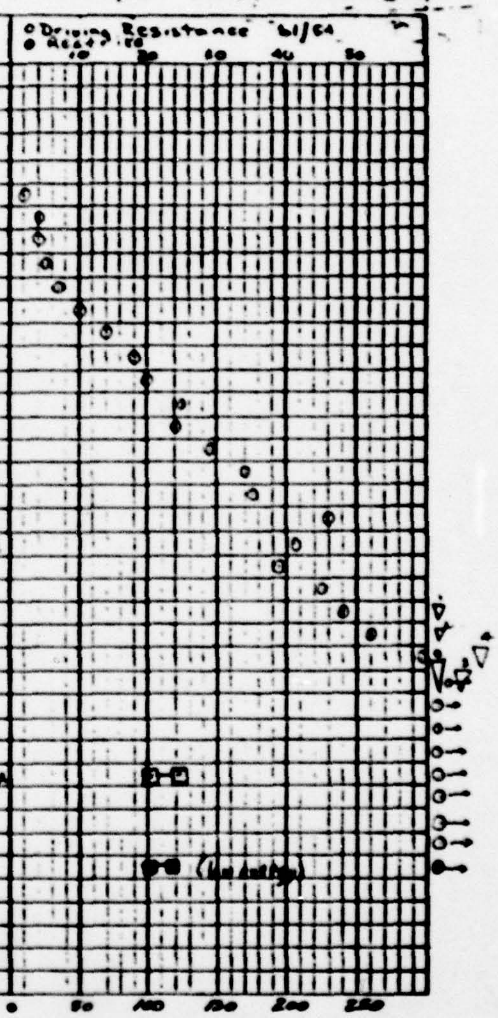
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 02 160 1 4600

Pile Type Douglas Fir Hammer Vulcan V1 Date 21 Oct 1978
Pile length 60 ft Energy 15000 ft lbs Time 22:30
Ground el. Travel Level Operating Rate 60 blows/min Inspector - Bob Green

Depth ft	Blows	Remarks
0-1		
2		[illegible] to 27'
3		[illegible] to 5'
4		
5		
6	2	
7	4	
8	4	
9	5	
10	7	
11	10	
12	14	
13	18	
14	20	
15	25	
16	24	
17	29	
18	34	
19	35	57 blows/min
20	46	
21	42	[illegible]
22	39	
23	45	
24	48	
25	52	
26	59	
27	68	Jetting, jet to 26'
28	67	
29	75	Jetting, jet to 25'
30	69	Jetting, jet to 27'
31	75	Jetting, jet to 26' Analyze
32	91	
33	118	
34	135	
35	41 for 6"	Restrike on 10/24/78 at 00:25 AM



Dynamic measurements YES

Sequence No.	Depth ft
01 (PDA)	30-31
02 (Restrike)	30-31

Notes:
Pile batter at F.R.R
5.5% S
1.2% E

WCC, TTC 825, Phase V Vol IIIA

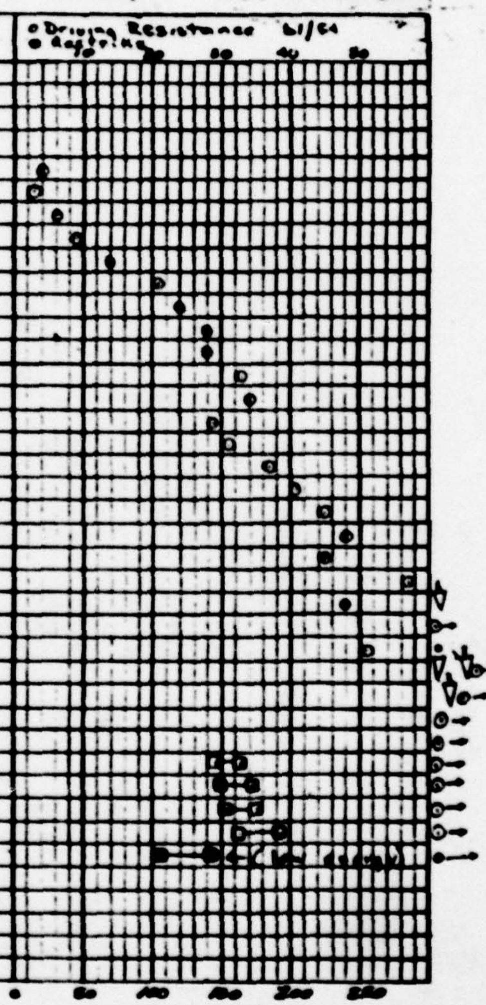
√ H.L.C.
10 Oct '78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

ID No. 03 02 160 1 08?0

Pile Type Douglas Fir — Hammer Vulcan V1 — Date 22 Oct 1978
Pile length 42' — Energy 15000 ft lbs — Time 00:60
Ground el. Trench level — Operating rate 60 blows/min — Inspector - Bob Green

Depth ft	Blows	Remarks
0-1		
2		Pre-jet to 27'
3		Pile runs to 4'6"
4		
5	28' 6"	
6	3	
7	6	
8	9	
9	16	
10	21	
11	26	
12	28	
13	28	
14	33	
15	36	
16	29	
17	31	
18	37	
19	41	
20	45	
21	48	
22	45	
23	57	
24	48	
25	65	
26	51	
27	71	Jet, jet to 26'
28	61	
29	75	Jet, jet to 27'
30	78	
31	93	analyzer Jet, jet to 28'
32	92	
33	102	
34	117	
35	116 for 6"	Restrike on 10/26/78 at 00:15 hr



Dynamic Measurements Yes

Sequence No	Depth ft
01 / (PDA)	30 - 34
02 / (Restrike)	34 - 34.5

Notes:
Pile bottom at E.O.D.
2.8% N
1.0% W

■ Restrike
▽ Jetting
✓ M.C.S.
Nov '79

WCC, 77C823, Phase II, Vol IIA

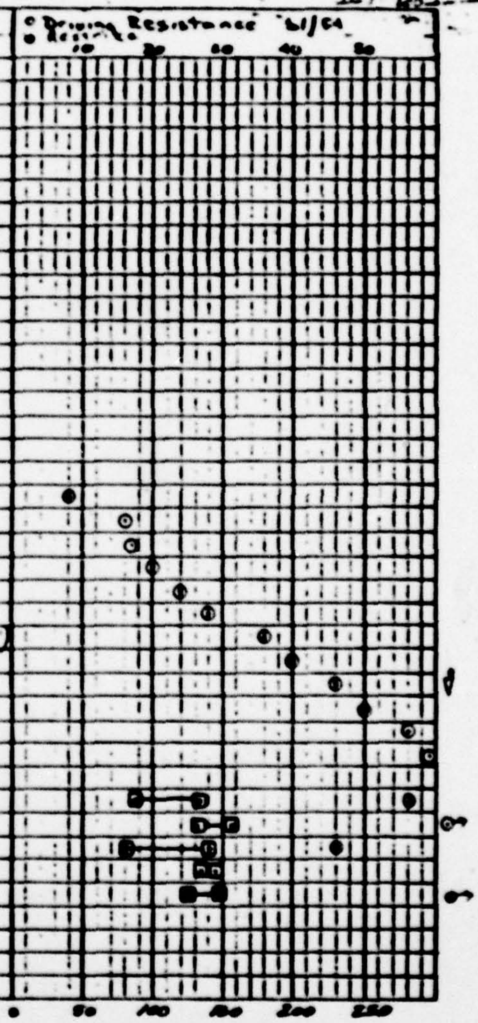
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 02 160 1 2000

Pile Type	Daylight Fox	Hammer	Vulcan VI	Date	10/22/78
Pile length	41.7'	Energy	15,000 ft-lbs	Time	7:00 – 9:06
Ground el.	Trench Level	Operating Rate	60 blows/min	Inspector	Guy Locke; D. T. [illegible]

Depth ft	Blows	Remarks
0-1		
2		Pre-jet to 27'
3		Pile sank to 10' depth
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		Small clay balls
14	[illegible]	lignite
15		
16		
17		lost circulation
18		
19	8	
20	16	
21	17	
22	20	
23	24	
24	28	
25	36	wood, lignite, clay balls (2-4")
26	40	
27	46	
28	50	
29	56	
30	59	
31	7 12 for 5'	Analyzer
32	56	56 blows/min
33	71	
34	46	56 blows/min
35	44 for 7.5'	
	17 for 6"	Re-strike on 10/26/78 at 00:27 hrs



● Capacity, kips
■ Restrike
▽ Jetting depth

Dynamic measurements yes

Sequence No.	Depth ft
01 (PDA)	31 - 34.6
02 (PDA)	34.6 - 35.1

Notes:
Pile batter at E.O.D.
0.2% S
3.3% E

WCC, 77C825, Phase IX
Vol IIIA

[illegible]
10 Oct '78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

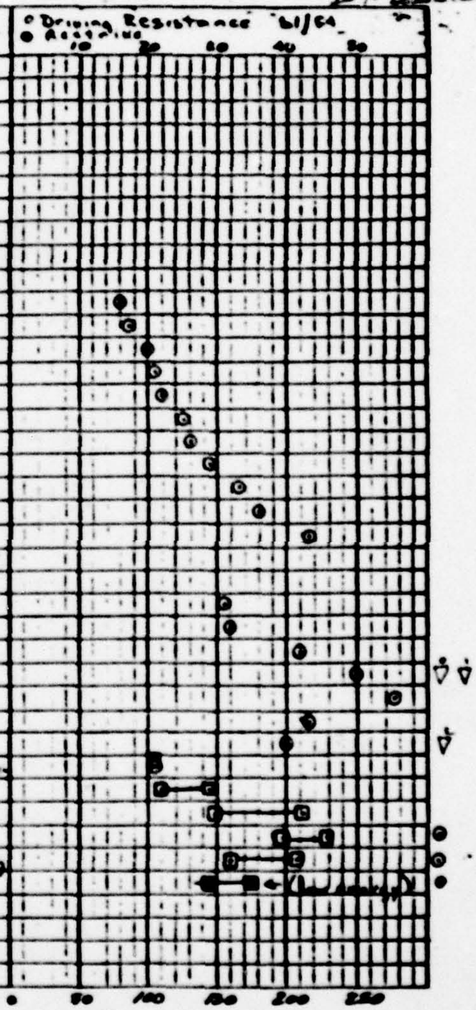
ID No. US 02 160 1 I000

Pile Type: Douglas Fir
Pile length: 42.00
Ground el.: Travel level

Hammer: Vulcan V1
Energy: 15,000 ft lbs
Operating Rate: 60 blows/min

Date: 10/22/78
Time: 10.00 – 13.00
Inspector: – Gary Locke, D.T. [illegible]

Depth ft	Blows	Remarks
0-1		
2		Jet to 27'
3		Pile pump to 2'
4		
5	29	
6	[illegible]	
7		[illegible]
8		8–10' wood [illegible]
9		
10		
11	16	
12	17	[illegible] at 12'
13	20	
14	21	
15	22	15' [illegible] calculation
16	25	
17	26	
18	29	
19	33	
20	36	gravel layer at 20'
21	43	
22		no data for blow count
23		no data for blow count
24	31	
25	32	
26	42	
27	50	
28	55	
29	43	
30	40	
31	21	Analyzer Set at 27 during driving
32	22	Set at 27
33	27 for 5"	Set at 30
34	74	Set at 30
35	63 for 6"	Set at 31 during driving
	73 for 6"	[illegible] on 10/24/78 at 00 [illegible]



Dynamic Measurements WES

Sequence No.	Depth ft
01 (PDA)	30 – 28.75
02 (Restrike)	28.75 – 35.25

□ Capacity, kips
● Restrike
▽ Jetting depth

Notes:
Pile batter at E.O.D.
0.5% N
1.6% E

J.G.L.
10 Oct '78

WCC, VTC 815, Phase II
Vol II A

M.2 SUMMARY LOG OF DATA ACQUIRED DURING PRELOADING, MONOLITH M2

ID No.: 07-02

MONOLITH(S) TESTED: M2

TEST TYPE: PRELOADING

	Sequence No.	0000	0005	0010	0012	0013
	Date/Time	1/13/79 1500	1/16/79 2145	1/17/79 1300	1/17/79 1620	1/17/79 2100
	Description of Event	INITIALIZATION NO LOADS	FULLY UNLOADED	FULL AXIAL NO LATERAL LOADS	FULL AXIAL & LATERAL LOADS "CYCLE 1"	FULL AXIAL UNLOAD LATERAL (H_2 H_0) LOADS "CYCLE 1"
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓		
	Optical Horizontal Control, P(1)	✓		✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓	✓		
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓(prior)		✓	✓	
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓(prior)		✓		
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)	✓ (prior)				
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	
	Thermo-couples, S(14)	✓	✓	✓	✓	
	Strain Gages, S(10)	BAL	✓		✓	
	Record No. – 02		4		5	
	N/A Record No. – 03					

Note: ✓ = Complete set of readings taken

ID No.: 07-02

MONOLITH(S) TESTED: M2

TEST TYPE: PRELOADING

	Sequence No.	0039	0059			
	Date/Time	1/18/79 1200	1/19/79 0930			
	Description of Event	FULL AXIAL & LATERAL LOADS CYCLE 15	FULL AXIAL & LATERAL LOADS CYCLE 30			
PRIMARY DATA	Dial Gages, P(1)	✓	✓			
	Optical Horizontal Control, P(1)	✓	✓			
	Optical Vertical Control, P(1)	✓	✓			
	Tape Extensometer, P(1)		✓			
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓	✓			
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)		✓			
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)	✓	PD304 only			
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓			
	Thermo-couples, S(14)	✓	✓			
	Strain Gages, S(10)					
	Record No. – 02		8			
	N/A Record No. – 03					

Note: ✓ = Complete set of readings taken

X7C825
Phase IV, Vol. I

M-[illegible]

M.3 SUMMARY LOG OF DATA ACQUIRED DURING
PILE DRIVING, MONOLITH M6

ID No.: 09-02-

MONOLITH(S) TESTED: M2&M6

TEST TYPE: PDET

	Sequence No.	0000	0001	0002	0104	0104
	Date/Time	1/21/79 2100	1/22 0700	1/23 1600	1/23 2135	1/25 0730
	Description of Event	INITIALIZATION FULL AXIAL LOAD	FULL AXIAL AND LATERAL LOADS	FULL AXIAL AND LATERAL LOADS	PILE NO.4 ~50ft HALF PENETRATION	PILE NO.4 ~50ft HALF PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓		✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)		✓	✓	✓	✓
	Tilt Meters, P(1)		✓			
SECONDARY DATA	Timber Pile Inclinometers, S(9)		✓			
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	✓
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)		✓			
	Sondex, S(12)		✓			
	Piezometers, S(13)		✓		✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	✓
	Strain Gages, S(10)		✓	✓		
	Record No. – 02		4	5		
	Record No. – 03					

Note: ✓ = Complete set of readings taken

ID No.: 09-02-

MONOLITH(S) TESTED: M2 & M6

TEST TYPE: PDET

	Sequence No.	0110	0204	0204	0208	0303
	Date/Time	1/25 1155	1/26 0100	1/26 1400	1/26 1928	1/27 0050
	Description of Event	PILE NO. 1 ~100ft FULL PENETRATION	PILE NO. 2 ~51ft HALF PENETRATION	PILE NO. 2 ~51ft HALF PENETRATION	PILE NO. 2 ~96ft FULL PENETRATION	PILE NO. 3 ~56ft HALF PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓	✓		✓	✓
PRIMARY DATA	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
PRIMARY DATA	Optical Vertical Control, P(1)	✓	✓		✓	✓
PRIMARY DATA	Tape Extensometer, P(1)	✓	✓		✓	✓
PRIMARY DATA	Tilt Meters, P(1)	✓				✓
PRIMARY DATA						
PRIMARY DATA						
PRIMARY DATA						
SECONDARY DATA	Timber Pile Inclinometers, S(9)					✓
SECONDARY DATA	Timber Pile Slopes, S(9)					
SECONDARY DATA	Tell Tales, S(10)	✓	✓		✓	✓
SECONDARY DATA	Surface Settlement, S(11)	✓			✓	
SECONDARY DATA	Ground Inclinometers, S(12)					
SECONDARY DATA	Sondex, S(12)					
SECONDARY DATA	Piezometers, S(13)	✓	✓		✓	✓
SECONDARY DATA	Thermo-couples, S(14)	✓	✓		✓	
SECONDARY DATA	Strain Gages, S(10)			✓	✓	✓
SECONDARY DATA						
SECONDARY DATA	Record No. – 02			6	7	8
SECONDARY DATA	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C825
Phase II, Vol II A

ID No.: 09-02-

MONOLITH(S) TESTED: M2&M6

TEST TYPE: FDET

	Sequence No.	0306	0403	0405	0405	0503
	Date/Time	1/27 1400	1/27 1945	1/28 0140	1/29 0710	1/29 1100
	Description of Event	PILE NO. 3 ~95ft FULL PENETRATION	PILE NO. 4 ~57ft HALF PENETRATION	PILE NO. 4 ~95ft FULL PENETRATION	PILE NO. 4 ~95ft FULL PENETRATION	PILE NO. 5 ~57ft HALF PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓		✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓	✓	✓	✓
	Tilt Meters, P(1)	✓				✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓			✓	
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓		
	Surface Settlement, S(11)	✓	✓			✓
	Ground Inclinometers, S(12)	✓			✓	
	Sondex, S(12)	✓				
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	✓
	Strain Gages, S(10)	✓	✓	✓		✓
	Record No. – 02	9	11	12		14
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C885
Phase II, Vol II A

ID No.: 09 - 02 -

MONOLITH(S) TESTED: M2 & M6

TEST TYPE: PDET

	Sequence No.	0504	0605	0607	0705	0709
	Date/Time	1/29 1700	1/30 0100	1/30 0840	1/30 2130	1/31 1300
	Description of Event	PILE NO. 5 ~96 ft FULL PENETRATION	PILE NO. 6 ~56 ft HALF PENETRATION	PILE NO. 6 ~95 ft FULL PENETRATION	PILE NO. 7 ~57 ft HALF PENETRATION	PILE NO. 7 ~95 ft FULL PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓	✓	✓	✓
	Tilt Meters, P(1)	✓	✓	✓	✓	✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)			✓		
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	
	Surface Settlement, S(11)	✓	✓	✓	✓	
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	✓
	Strain Gages, S(10)	✓	✓	✓	✓	✓
	Record No. – 02	15	16	53	54	55
	Record No. – 03					

Note: ✓ = Complete set of readings taken

[illegible]
[illegible]

[illegible]

ID No.: 09-02-

MONOLITH(S) TESTED: M2 & M6

TEST TYPE: PDET

	Sequence No.	0803	0806	0903	0907	1003
	Date/Time	1/31 1735	1/31 2345	2/1 1830	2/1 2310	2/1 0225
	Description of Event	PILE NO. 8 ~47 ft HALF PENETRATION	PILE NO. 8 ~94 ft FULL PENETRATION	PILE NO. 9 ~47 ft HALF PENETRATION	PILE NO. 9 ~95 ft FULL PENETRATION	PILE NO. 10 ~51 ft HALF PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓	✓	✓	✓
	Tilt Meters, P(1)	✓	✓	✓	✓	✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)		✓			
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	✓
	Surface Settlement, S(11)		✓			
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	✓
	Strain Gages, S(10)	✓	✓	✓	✓	✓
	Record No. – 02	56	57	58	60	61
	Record No. – 03					

Note: ✓ = Complete set of readings taken

ID No.: 09-02-

MONOLITH(S) TESTED: M2&M6

TEST TYPE: PDET

		1003	1005	1202	1300	1302
	Sequence No.	1003	1005	1202	1300	1302
	Date/Time	2/2 0900	2/2 1230	2/3 0110	2/3 0730	2/3 1530
	Description of Event	PILE NO.10 ~51 ft HALF PENETRATION	PILE NO.10 ~95 ft FULL PENETRATION	PILE NO.12 ~53 ft FULL PENETRATION	PILE NO.13 START	PILE NO.13 ~51 ft FULL PENETRATION
PRIMARY DATA	Dial Gages, P(1)		✓	✓	✓	✓
PRIMARY DATA	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
PRIMARY DATA	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
PRIMARY DATA	Tape Extensometer, P(1)		✓	✓	✓	✓
PRIMARY DATA	Tilt Meters, P(1)		✓		✓	
PRIMARY DATA						
PRIMARY DATA						
PRIMARY DATA						
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓				
SECONDARY DATA	Timber Pile Slopes, S(9)					
SECONDARY DATA	Tell Tales, S(10)		✓	✓	✓	✓
SECONDARY DATA	Surface Settlement, S(11)		✓		✓	✓
SECONDARY DATA	Ground Inclinometers, S(12)		✓		✓	
SECONDARY DATA	Sondex, S(12)				✓	
SECONDARY DATA	Piezometers, S(13)		✓	✓	✓	✓
SECONDARY DATA	Thermo-couples, S(14)		✓	✓	✓	✓
SECONDARY DATA	Strain Gages, S(10)		✓	✓	✓	✓
SECONDARY DATA						
SECONDARY DATA	Record No. – 02		62 COPY 1	4 COPY 2	5	6
SECONDARY DATA	Record No. – 03					

Note: ✓ = Complete set of readings taken

ID No.: 09-02-

MONOLITH(S) TESTED: M2 & M6

TEST TYPE: PDET

	Sequence No.	1404	1408			
	Date/Time	2/3 2000	2/4 0030			
	Description of Event	PILE NO 14 ~51ft FULL PENETRATION	ZERO LATERAL FULL AXIAL LOADS			
PRIMARY DATA	Dial Gages, P(1)	✓	✓			
	Optical Horizontal Control, P(1)	✓	✓			
	Optical Vertical Control, P(1)	✓	✓			
	Tape Extensometer, P(1)	✓	✓			
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓			
	Surface Settlement, S(11)	✓				
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓			
	Thermo-couples, S(14)	✓	✓			
	Strain Gages, S(10)	✓	✓			
	Record No. – 02	7	8			
	Record No. – 03					

Note: ✓ = Complete set of readings taken

[illegible]
[illegible]

M.4 SUMMARY LOG OF DATA ACQUIRED DURING LATERAL LOAD TESTING, MONOLITH M2

ID No.: 10-02-

MONOLITH(S) TESTED: M2

TEST TYPE: LOAD TEST

	Sequence No.	0000	0003	0006	0009	0010
	Date/Time	2/5/79 1030	2/5/79 2200	2/6/79 0010	2/6/79 05[illegible]	2/[illegible]/79 1900
	Description of Event	FULL AXIAL LOAD, NO LATERAL LOAD INITIALIZE	400t AXIAL ZERO LATERAL LOADS	FULL AXIAL (V_L = 240t) ZERO LATERAL LOAD	FULL AXIAL 48t (H_L) LATERAL LOADS	FULL AXIAL 72 t LATERAL LOADS
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓	✓	✓	✓
	Tilt Meters, P(1)	✓			✓	
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓			✓	✓
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	✓
	Surface Settlement, S(11)	✓	✓		✓	✓
	Ground Inclinometers, S(12)	✓			✓	
	Sondex, S(12)		(PD3D4)			
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)		✓	✓	✓	✓
	Strain Gages, S(10)	✓	✓			
	Record No. – 02	4	5,6	7	8	9
	N/A Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C835

Phase IV, Vol III A

ID No.: 10-02

MONOLITH(S) TESTED: M2

TEST TYPE: LOAD TEST

	Sequence No.	0011	0014	0017	0021	
	Date/Time	2/7/79 1730	2/8/79 1500	2/9/79 0230	2/12/79 0845	
	Description of Event	FULL AXIAL 96t LATERAL LOADS	FULL AXIAL 120t LATERAL LOADS	FULL AXIAL 144t LATERAL LOADS	FULLY UNLOADED	
PRIMARY DATA	Dial Gages, P(1)	✓	(partial)	(partial)		
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	
	Optical Vertical Control, P(1)	✓	✓	✓	✓	
	Tape Extensometer, P(1)	✓	✓	✓		
	Tilt Meters, P(1)			✓		
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓	✓			
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓		
	Surface Settlement, S(11)	✓			✓	
	Ground Inclinometers, S(12)	✓			✓	
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓		
	Thermocouples, S(14)	✓	✓	✓		
	Strain Gages, S(10)					
	Record No. – 02	10	11	12, 13, 14	15 (on 2/9)	
	N/A Record No. – 03					

Note: ✓ = Complete set of readings taken

M.5 COMPLETE DRIVING RECORDS OF PROTOTYPE PILES DRIVEN WITH IMPACT HAMMERS, MONOLITH M2

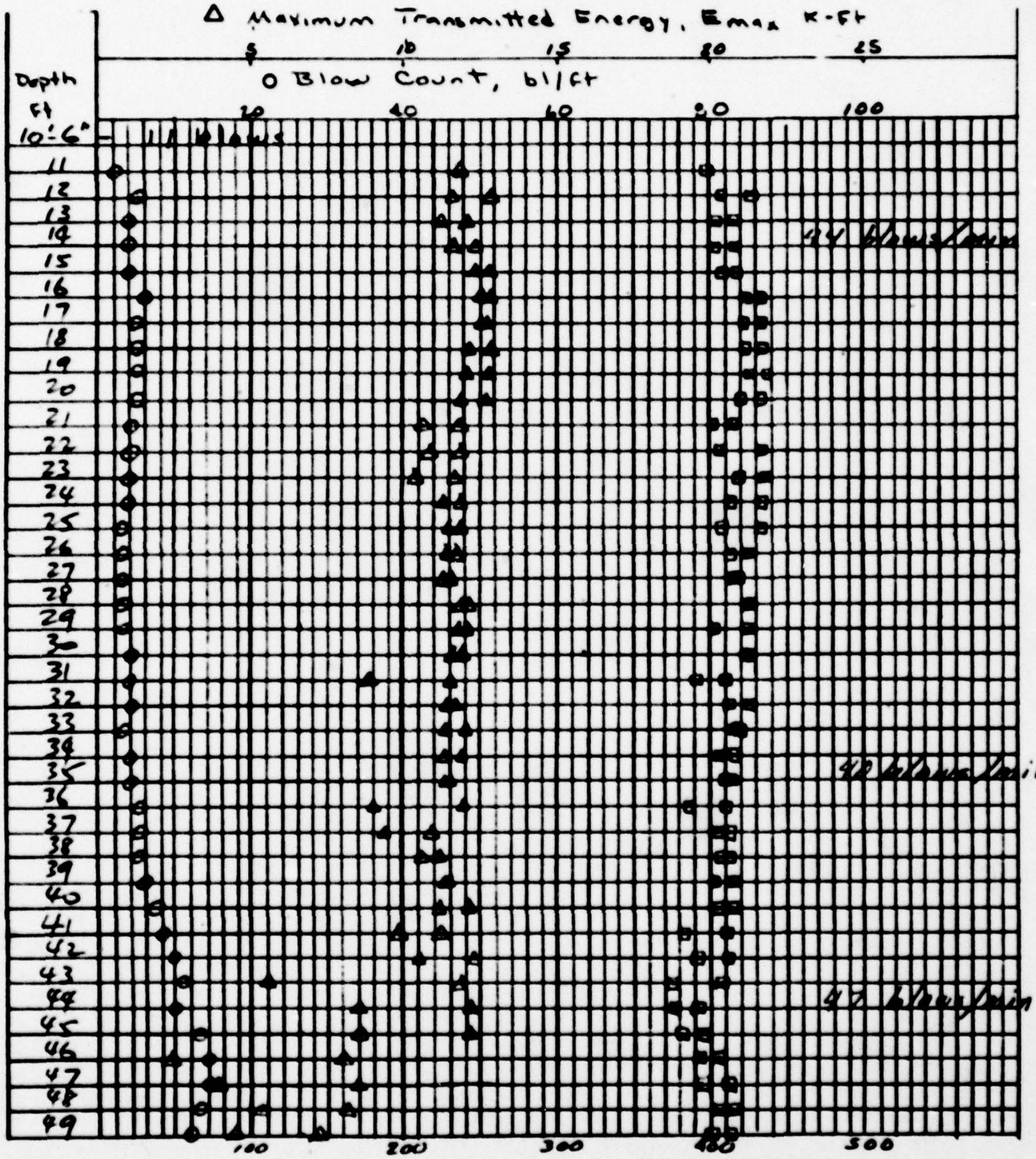
The driving records are presented in chronological order of driving for prototype piles No. 1 through 6, driven with a VULCAN 010 hammer and prototype piles No. 7, 8, 13, 14, driven with a MKT DE 70 B hammer.

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 21 02 190 0 0100
Date 23 JAN 79
operator JSL

PILE DRIVING MEASUREMENTS
PILE NO. 01
50 ft M2

	Time	Sequence No
First	23 JAN 79	0101
Finish	11:27 23 JAN 79	



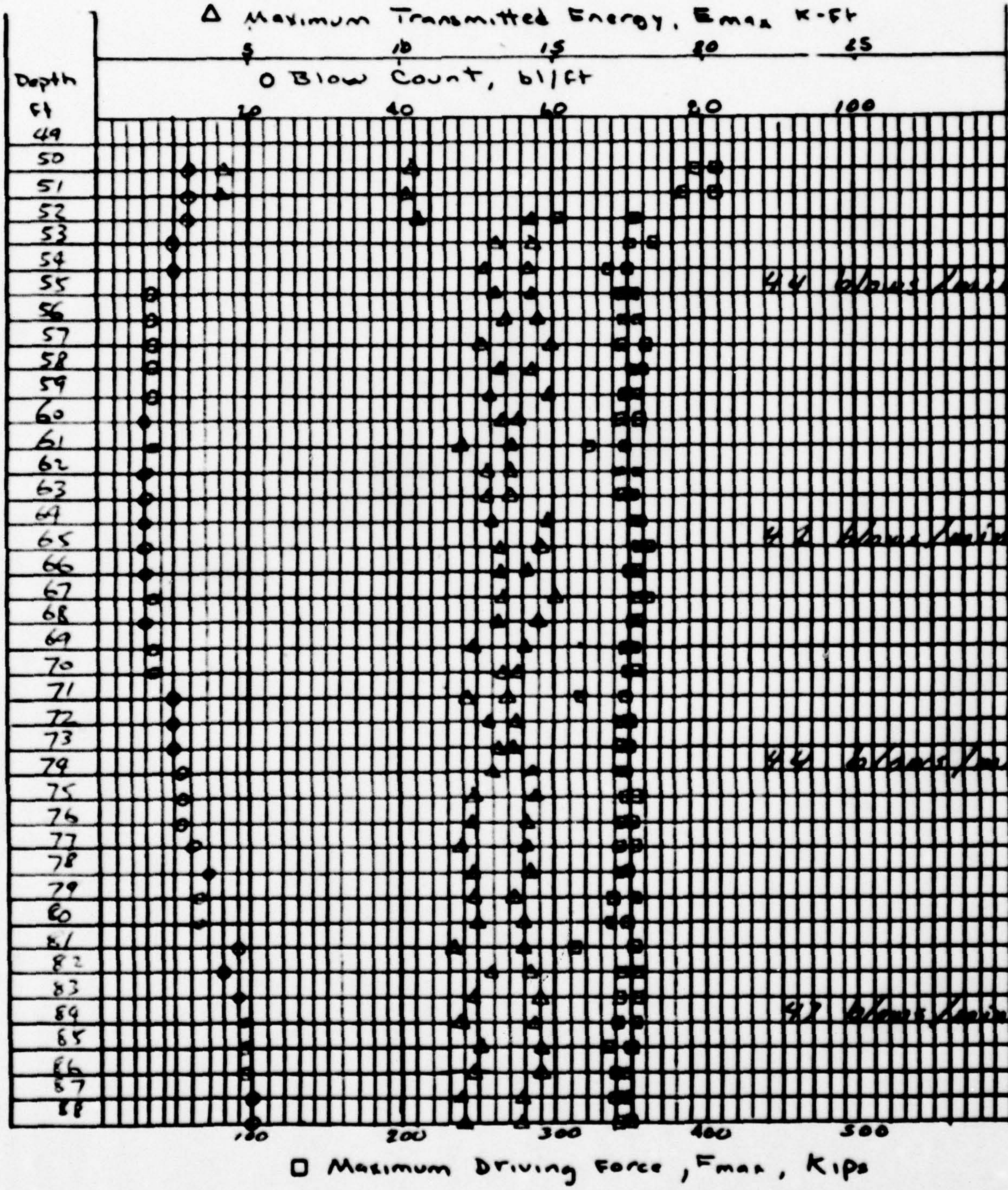
WCC, Y7C825, Phase IV ; Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 0 0103
Date 1/23/79
operator JSL

PILE DRIVING MEASUREMENTS
PILE NO. 01 M2

	Time	Sequence No
First		
Finish		



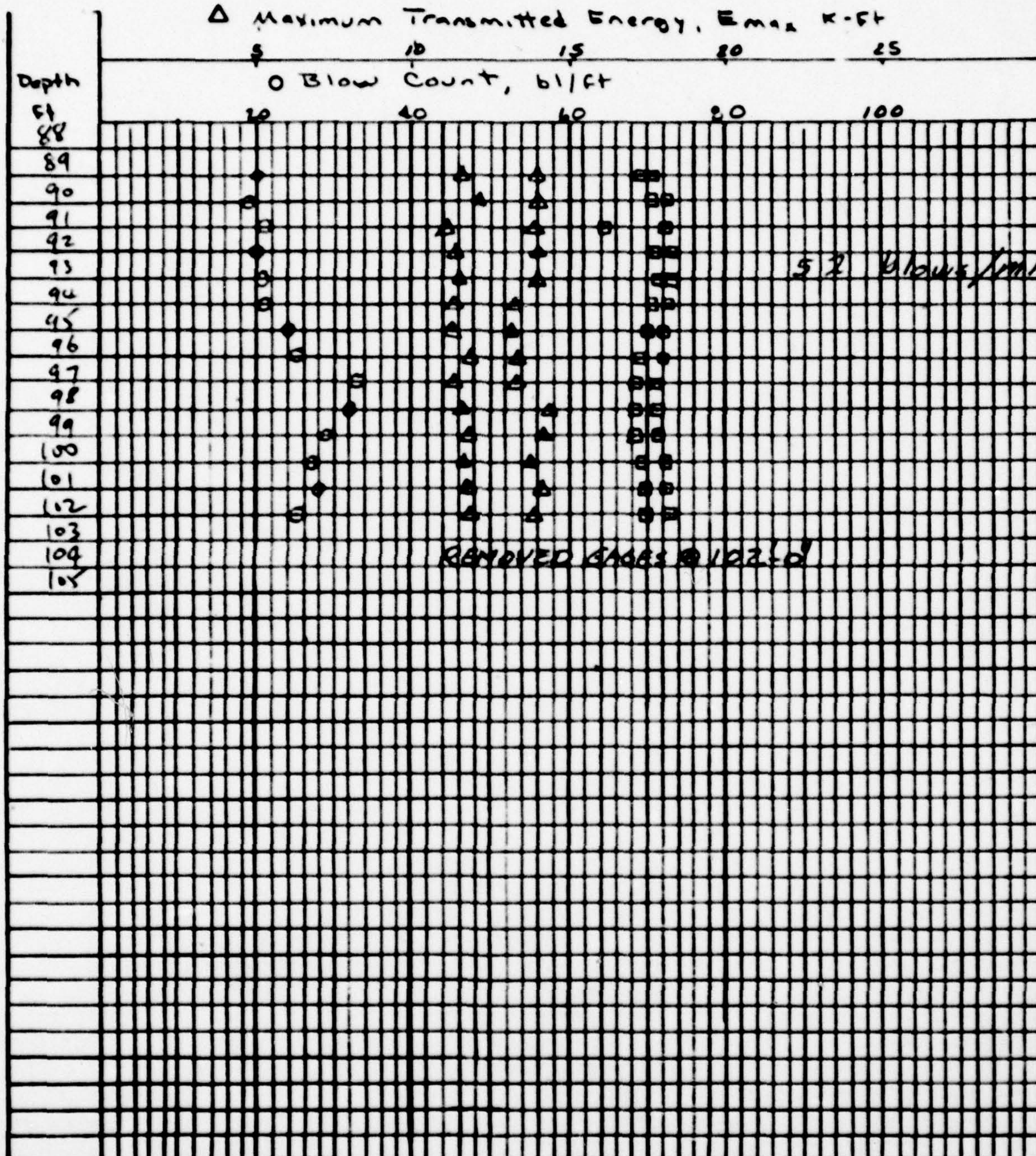
WCC, Y7C825, Phase IV; Vol IIIA

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM No. 26
PILE DRIVING EFFECTS TEST

I.D. No 07 22 120 2 0100
Date
operator

PILE DRIVING MEASUREMENTS
PILE No. 01 M2

	Time	Sequence No
First		
Finish		



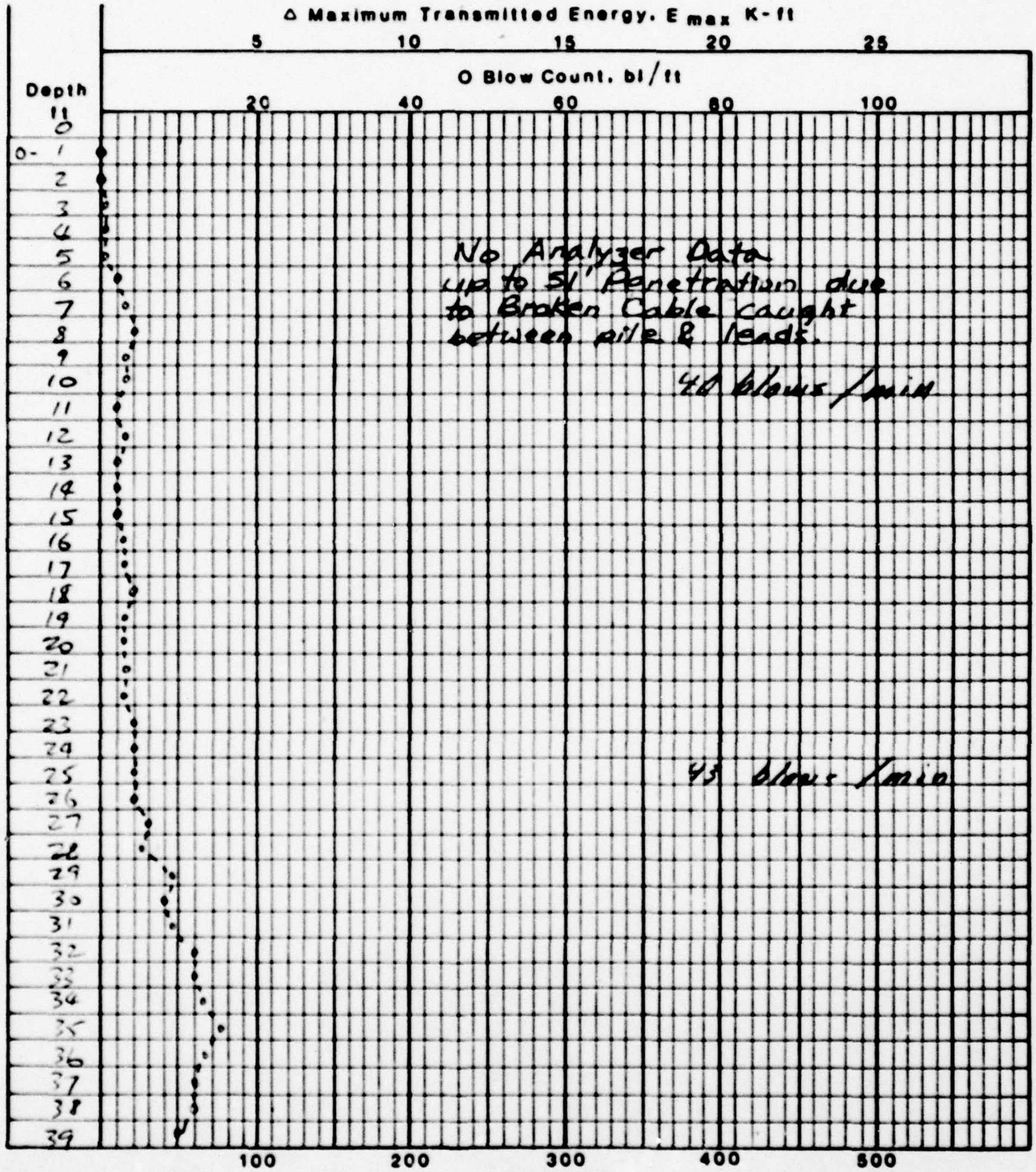
WCC, Y7C825, Phase IV; Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 0 0200
Date 25 JAN 79
Operator ~~LEL~~ SEK

PILE DRIVING MEASUREMENTS
PILE NO. 02

	Time	Sequence No.
First		0201
Finish	19:12 26 JAN 79	0208



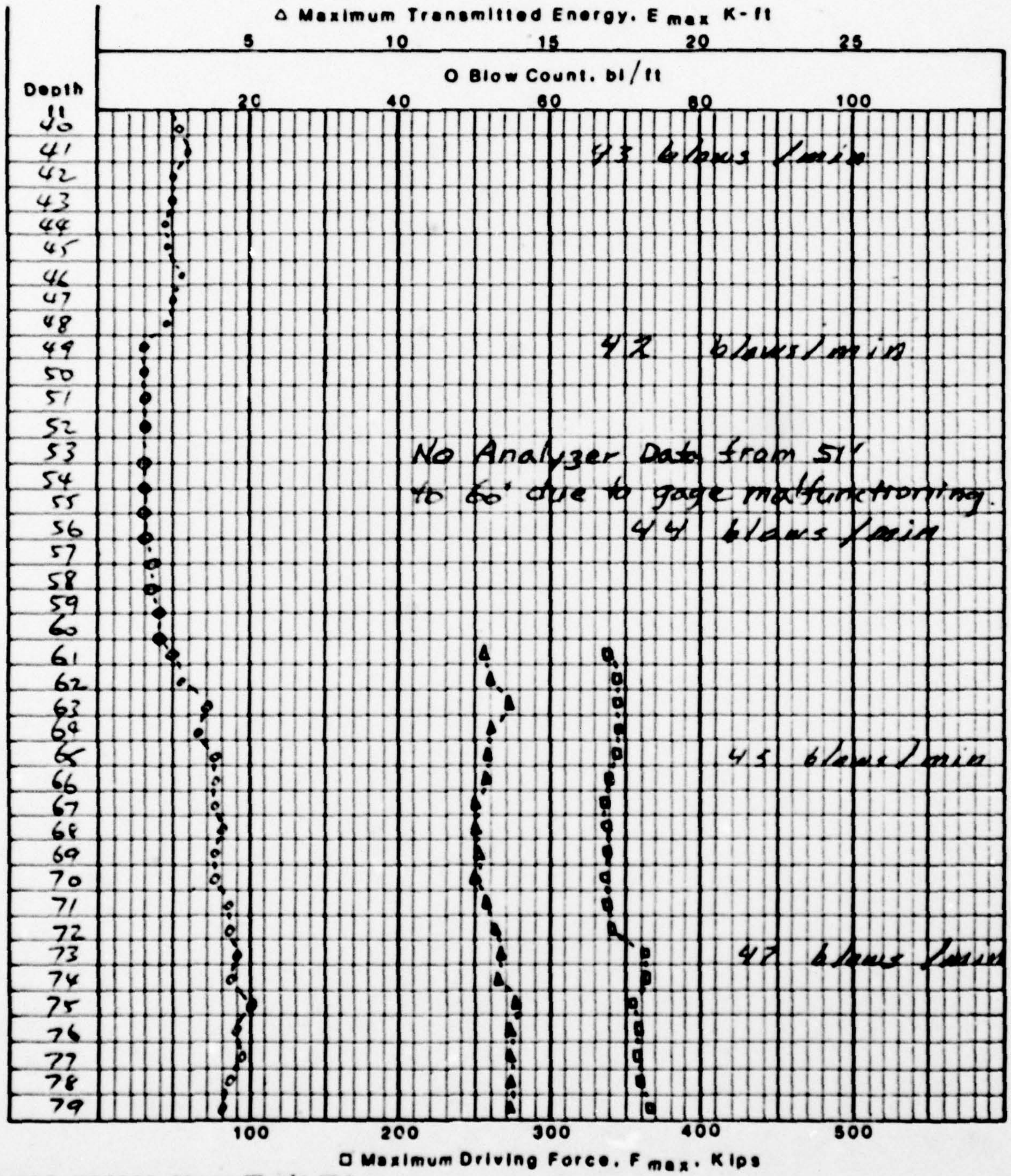
WCC, Y7C825, Phase IV, Vol II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 0 0300
Date 1/25/79
Operator SEK

PILE DRIVING MEASUREMENTS
PILE NO. 02

	Time	Sequence No.
First		
Finish		



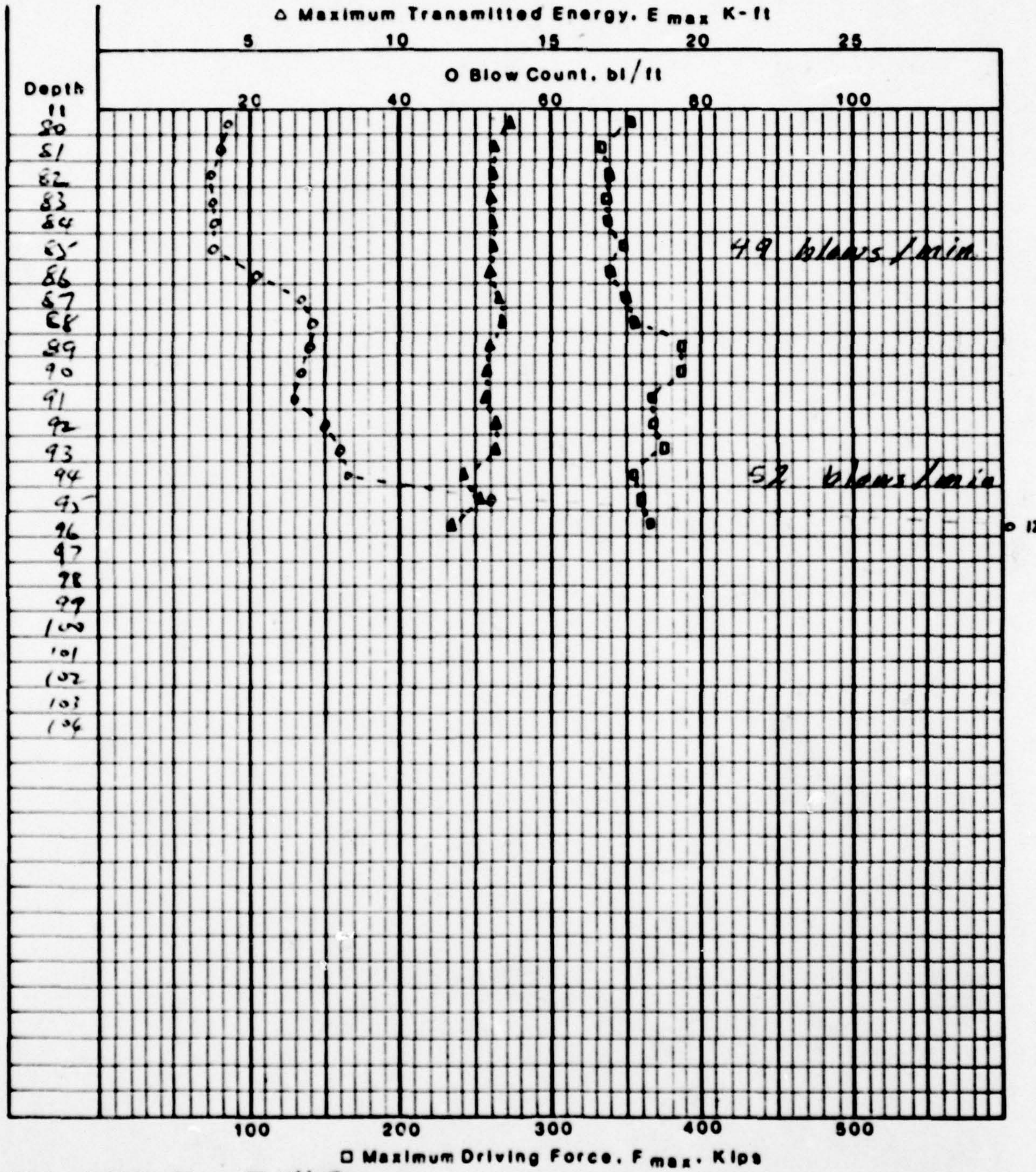
WCC. Y7C825. Phase IV; Vol IIIA

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 0 0200
Date 1/25/79
Operator SEK

PILE DRIVING MEASUREMENTS
PILE NO. 02

	Time	Sequence No.
First		
Finish		



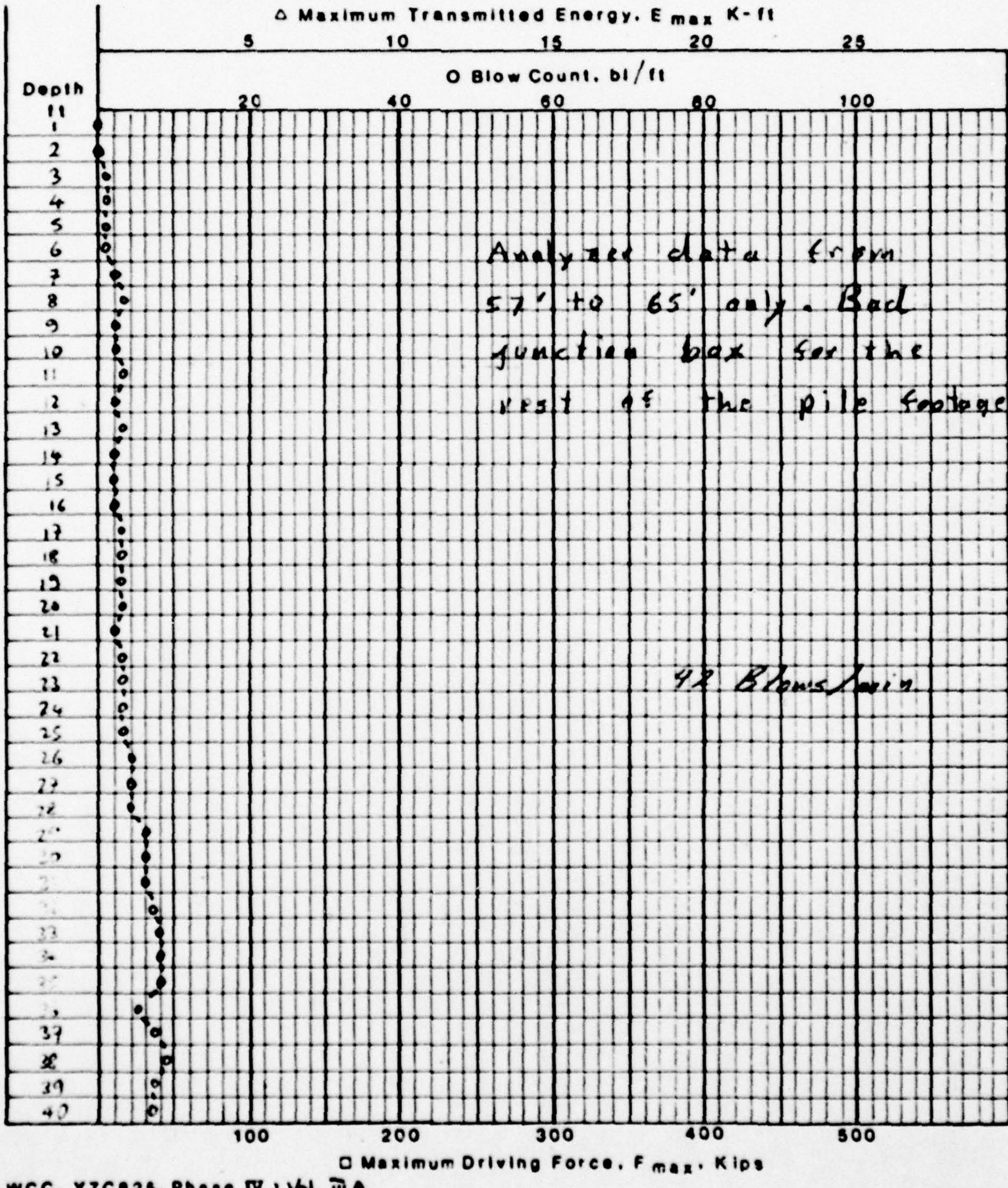
WCC, Y7C825, Phase IV; Vol IIA

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. [illegible]
Date [illegible]
Operator SEK

PILE DRIVING MEASUREMENTS
PILE NO. 03

	Time	Sequence No.
First		
Finish		



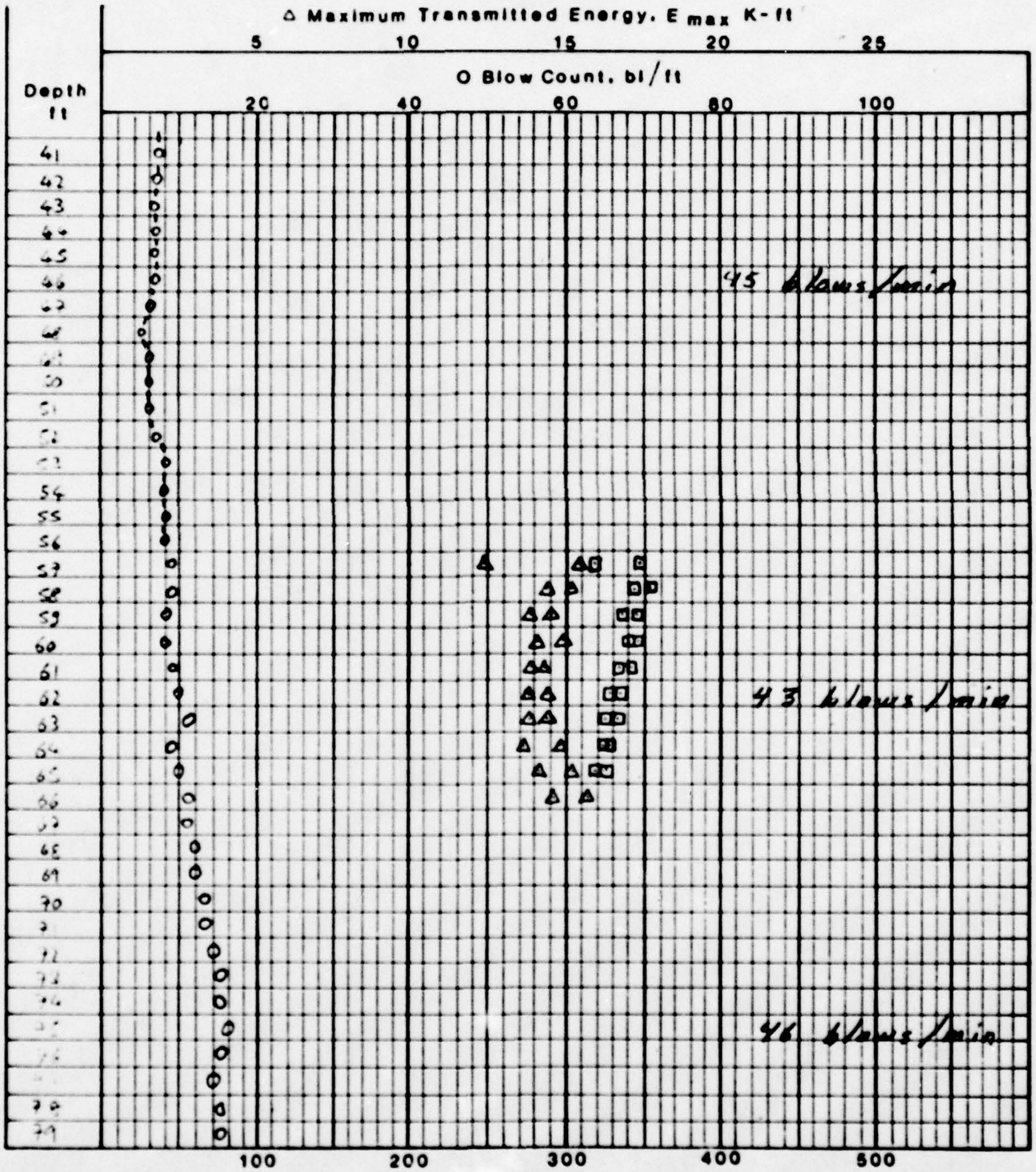
WCC. Y7C825. Phase IV ; Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 : 2300
Date 11/27/79
Operator SEK

PILE DRIVING MEASUREMENTS
PILE NO. 03

	Time	Sequence No.
First		
Finish		



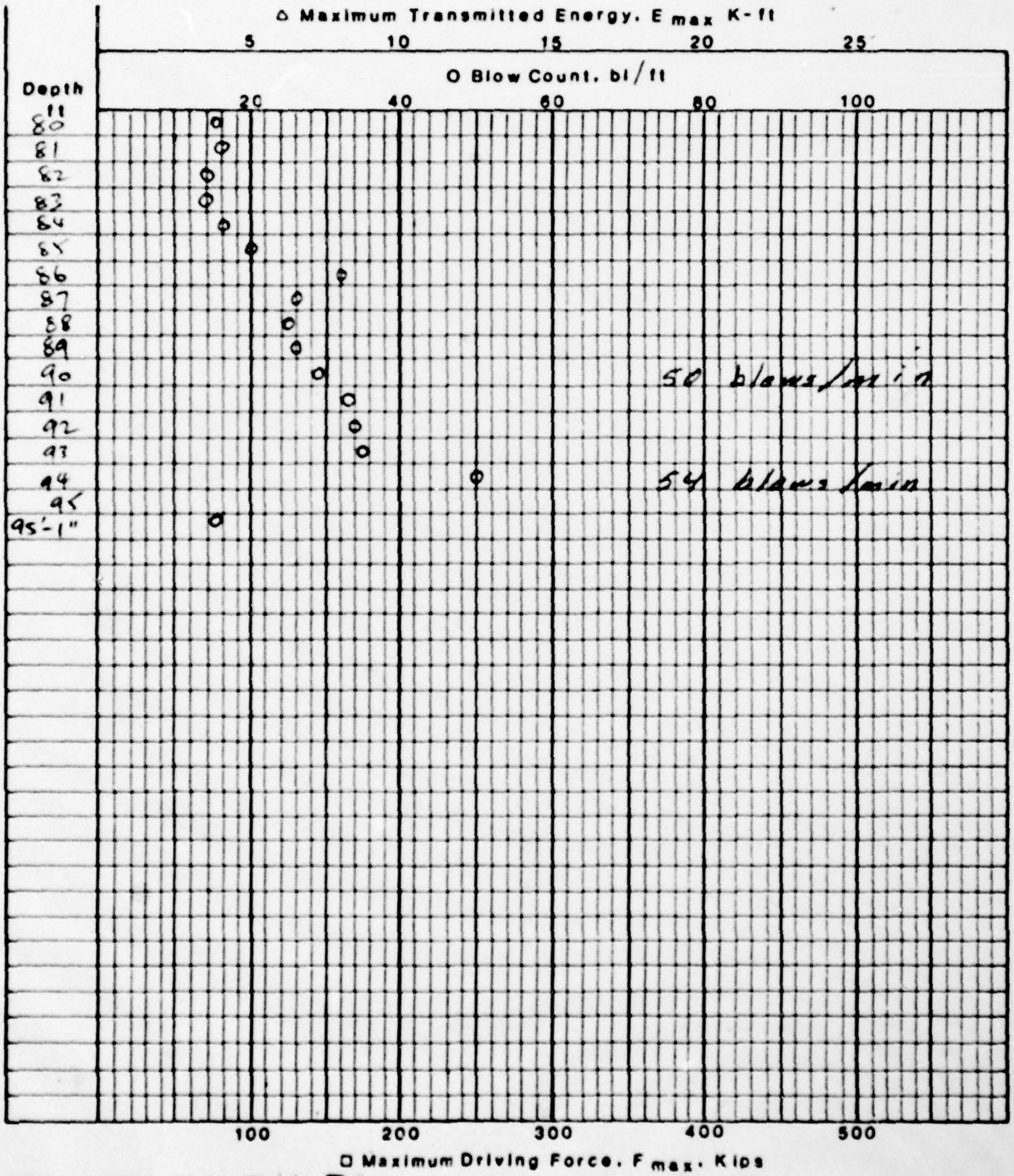
WCC, Y7C825, Phase IV, Vol. III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 0222
Date 11/27/79
Operator SEK

PILE DRIVING MEASUREMENTS
PILE NO. 03

	Time	Sequence No.
First		
Finish		



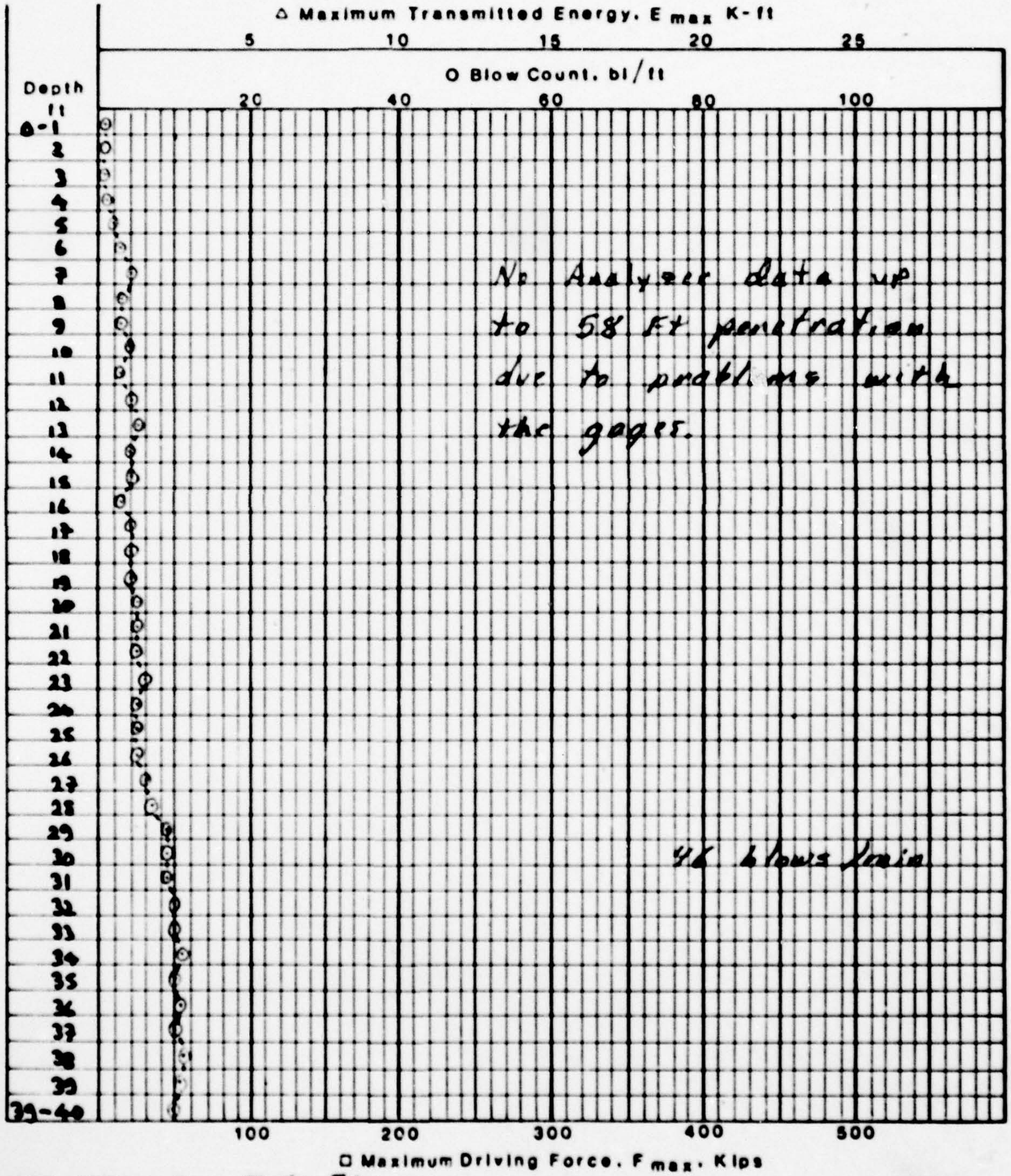
WCC. Y7C625. Phase IV ; Vol. VI A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 0 0400
Date 27 Jan 79
Operator SEK

PILE DRIVING MEASUREMENTS
PILE NO. 04

	Time	Sequence No.
First	18:55	0401
Finish	01:19 1/28	0405



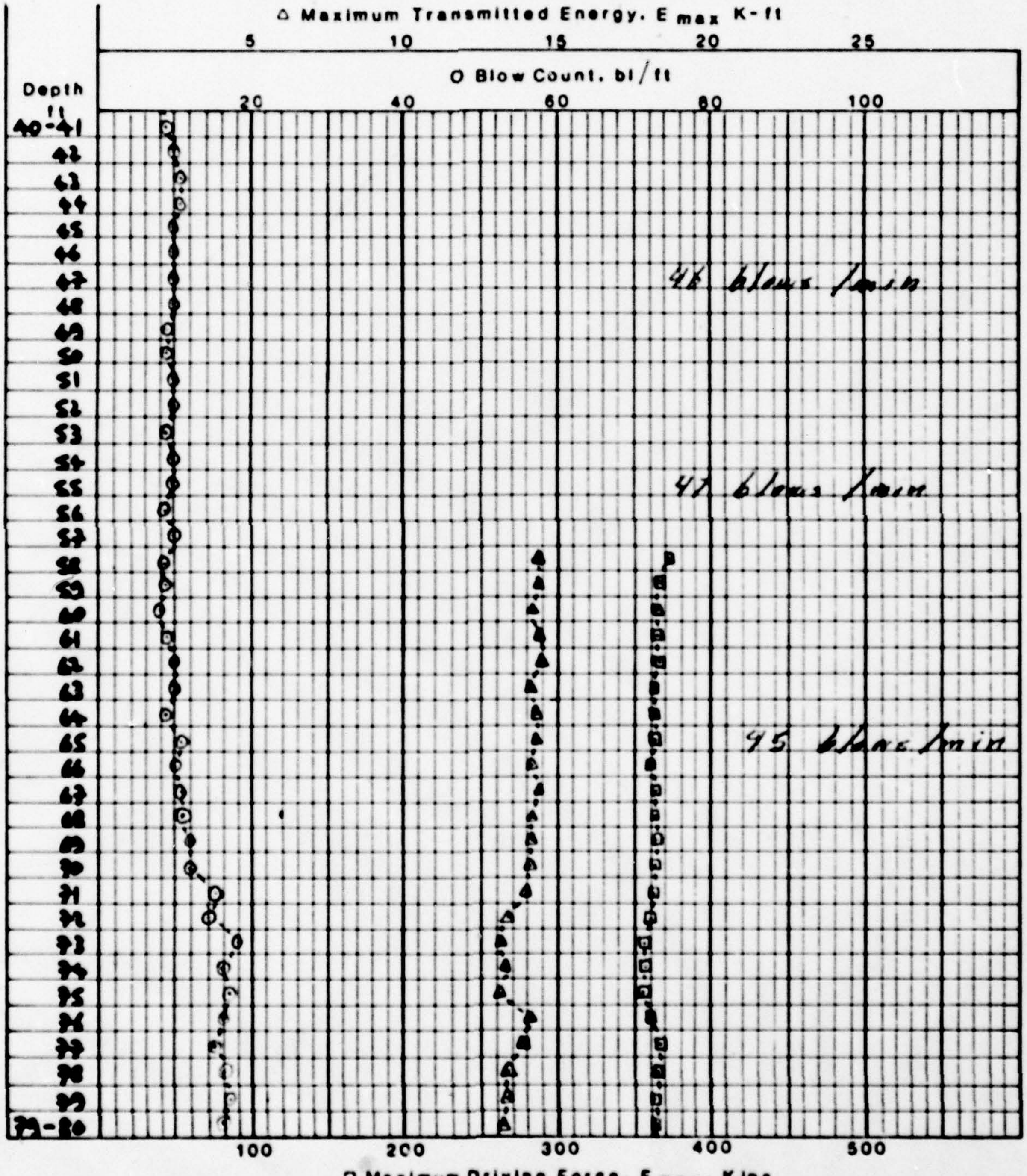
WCC, Y7C825, Phase IV; Vol. II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 0 0400
Date 11/22/79
Operator AZ

PILE DRIVING MEASUREMENTS
PILE NO. 04

	Time	Sequence No.
First		
Finish		



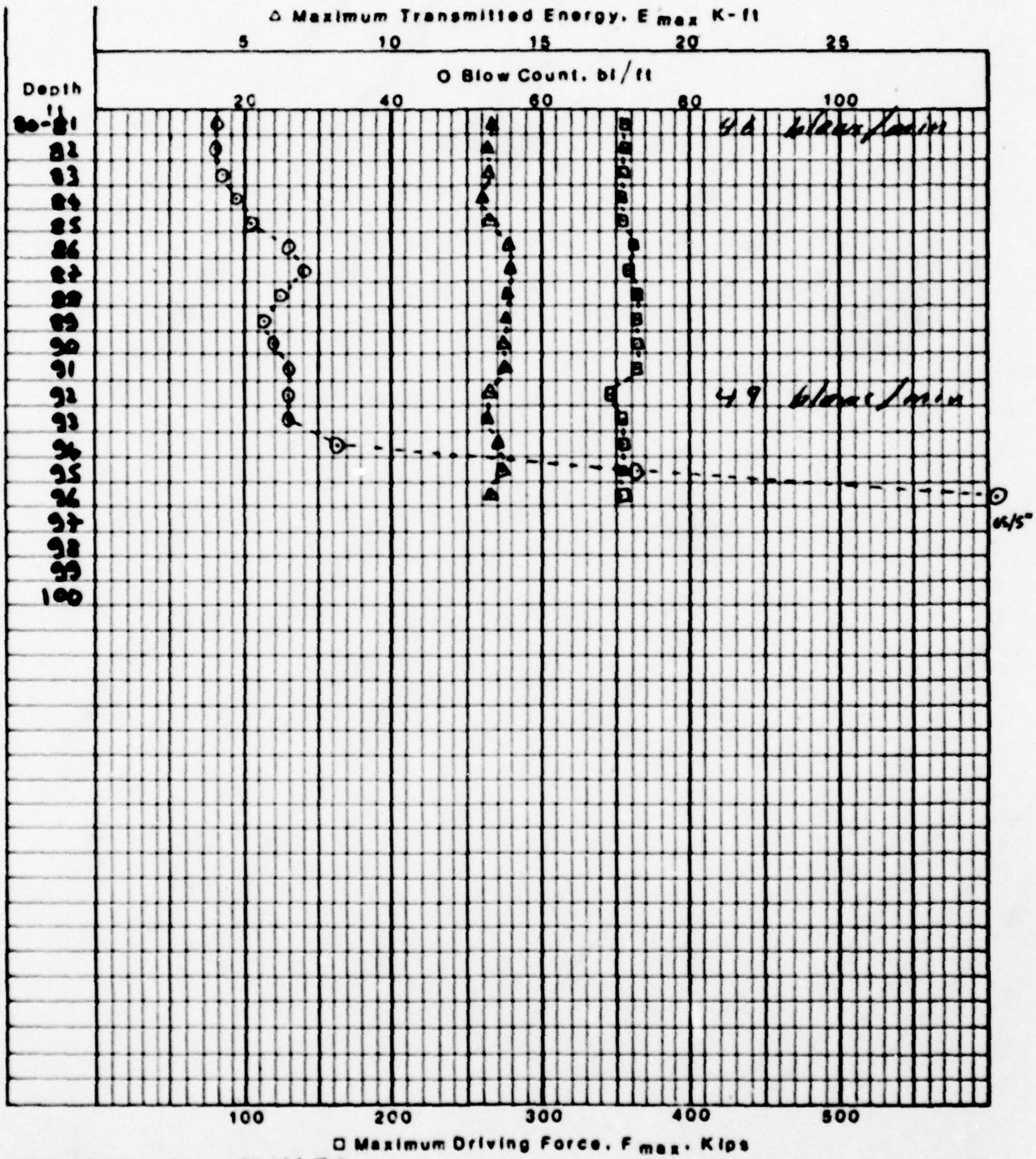
WCC, Y7C825, Phase IV ; Vol IIA

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 0 0600
Date 1/27/79
Operator AZ

PILE DRIVING MEASUREMENTS
PILE NO. Ø4

	Time	Sequence No.
First		
Finish		



WCC, Y7C825, Phase IV; Vol. II A

WOODWARD-CLYDE CONSULTANTS

LOCKS AND DAM NO. 26

PILE DRIVING EFFECTS TEST

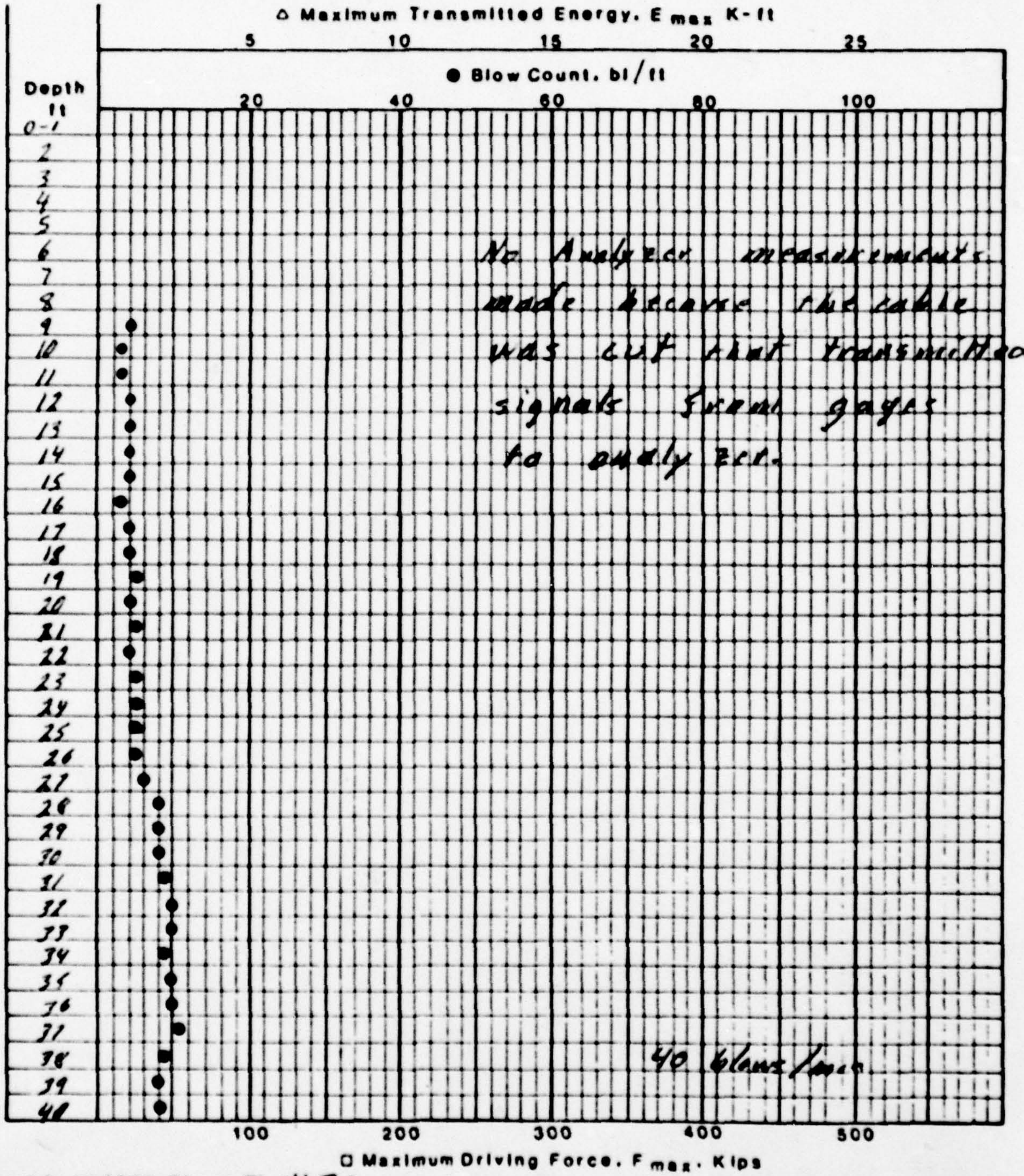
I.D. No. 09 02 182 [illegible]

Date [illegible]

Operator [illegible]

PILE DRIVING MEASUREMENTS
PILE NO. 05

	Time	Sequence No.
First		
Finish		



WCC. Y7C825. Phase IV ; Vol III-4

WOODWARD-CLYDE CONSULTANTS

LOCKS AND DAM NO. 26

PILE DRIVING EFFECTS TEST

M-35

I.D. No. 09 02 180 1 0500

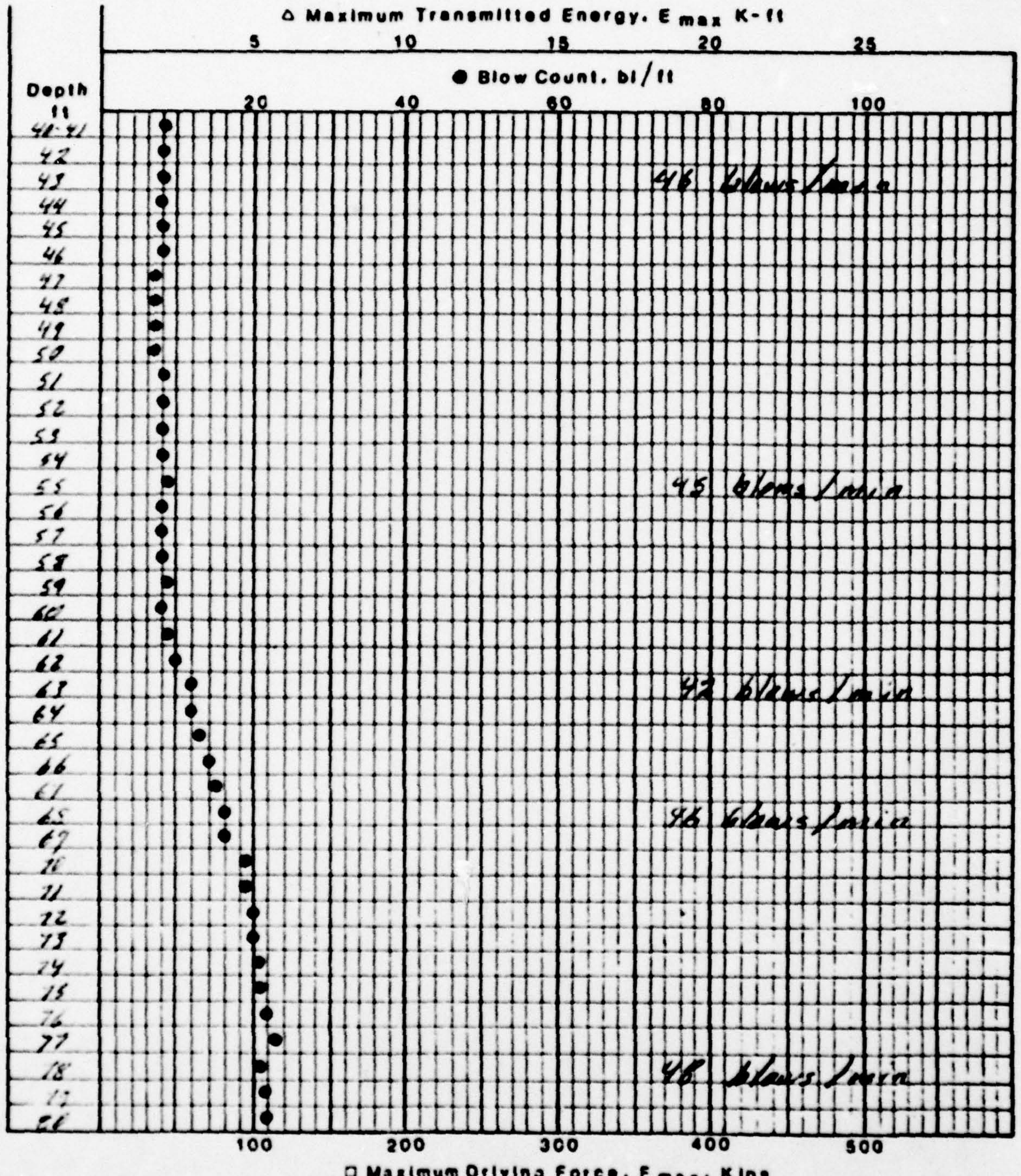
Date 11/27/79

Operator SEK

PILE DRIVING MEASUREMENTS

PILE NO. 05

	Time	Sequence No.
First		
Finish		



WCC. Y7C625, Phase II; Vol. IIIA

WOODWARD-CLYDE CONSULTANTS

LOCKS AND DAM NO. 26

PILE DRIVING EFFECTS TEST

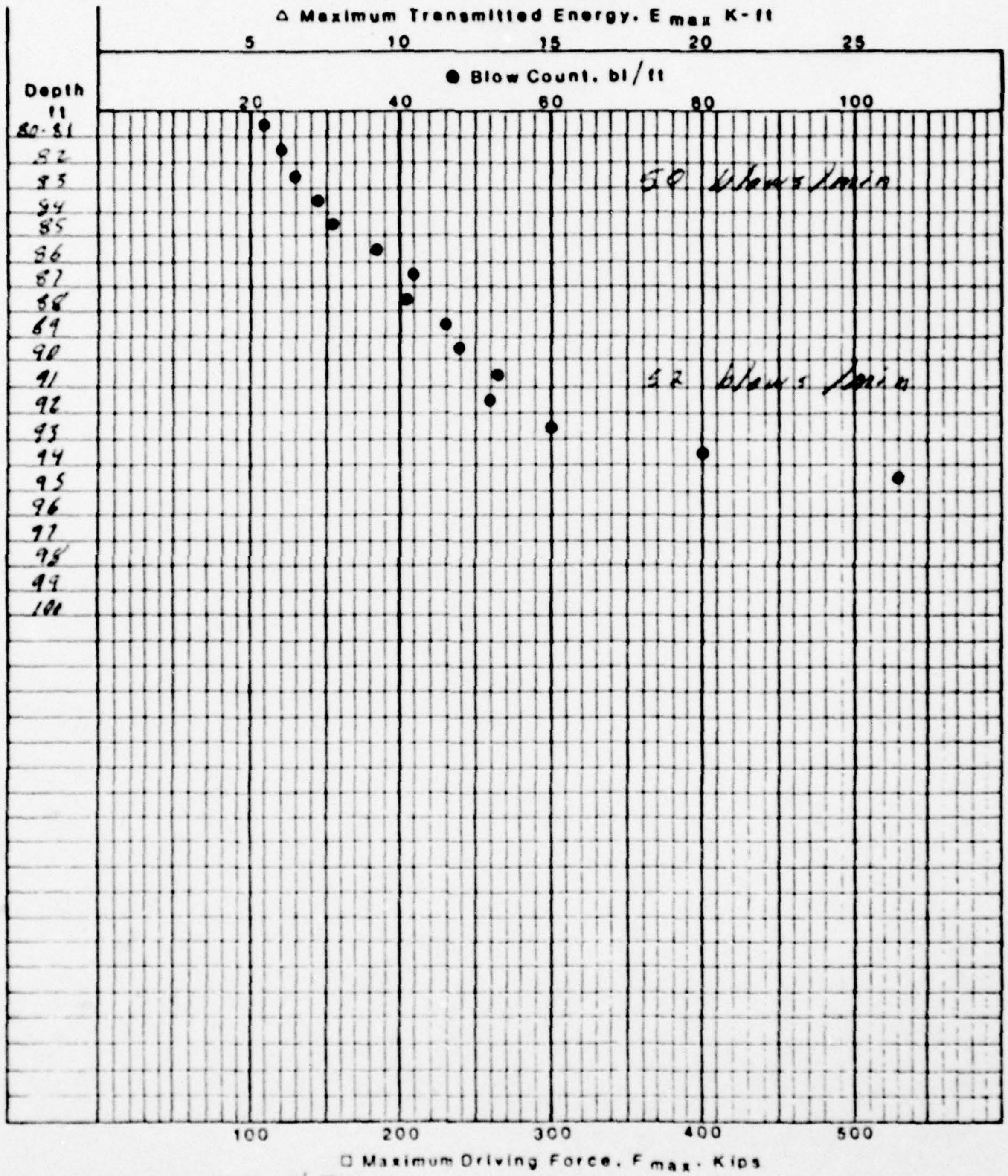
I.D. No. 09 02 180 1 0500

Date 1/29/79

Operator SEK

PILE DRIVING MEASUREMENTS
PILE NO. 05

	Time	Sequence No.
First		
Finish		



WCC, Y7C825, Phase IV, Vol III A

WOODWARD-CLYDE CONSULTANTS

LOCKS AND DAM NO. 26

PILE DRIVING EFFECTS TEST

I.D. No. 07 02 180 1 0600

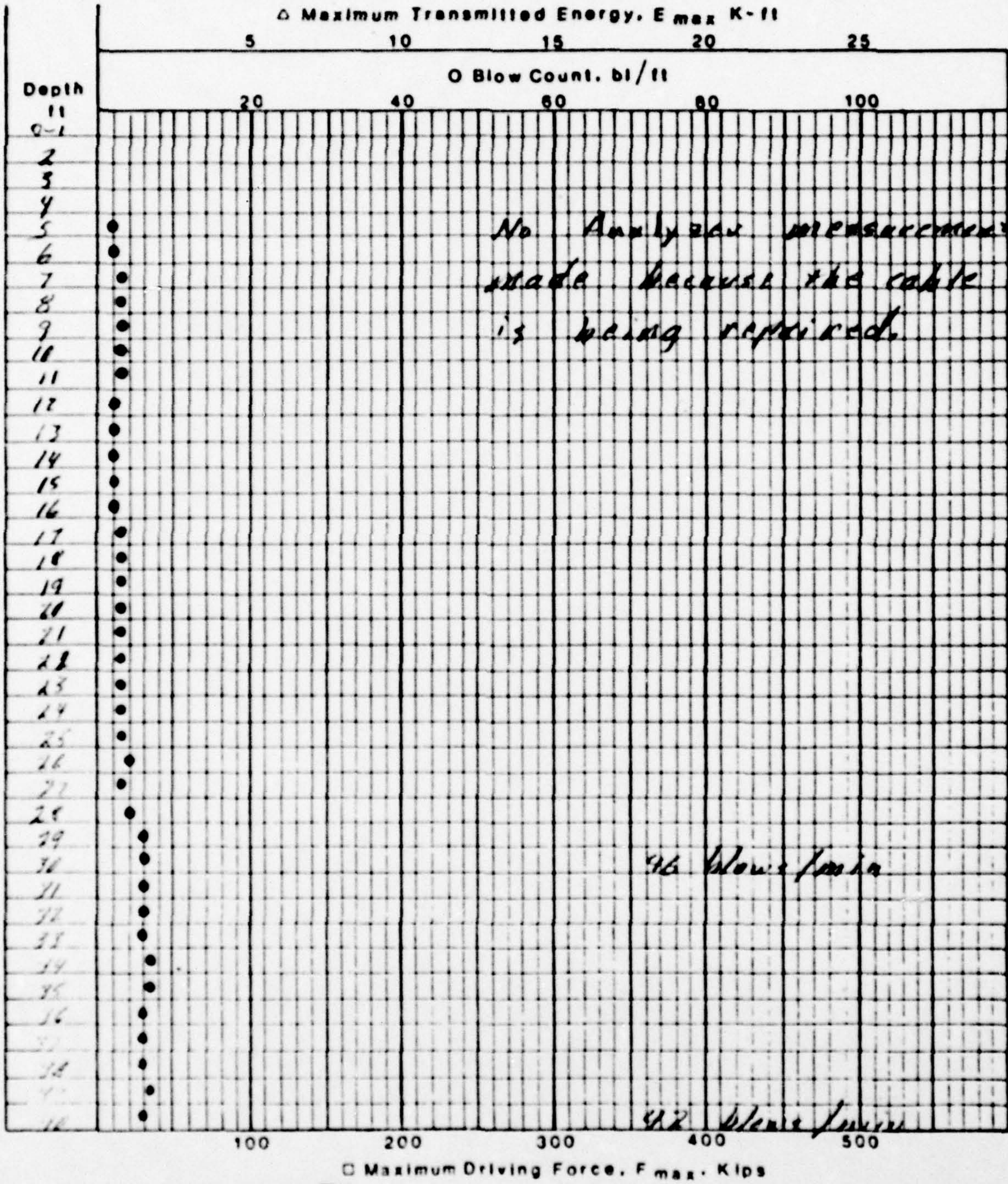
Date 11/29/77

Operator JSL

PILE DRIVING MEASUREMENTS

PILE NO. 06

	Time	Sequence No.
First		
Finish		



WCC. Y7C625. Phase IV, Vol. III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

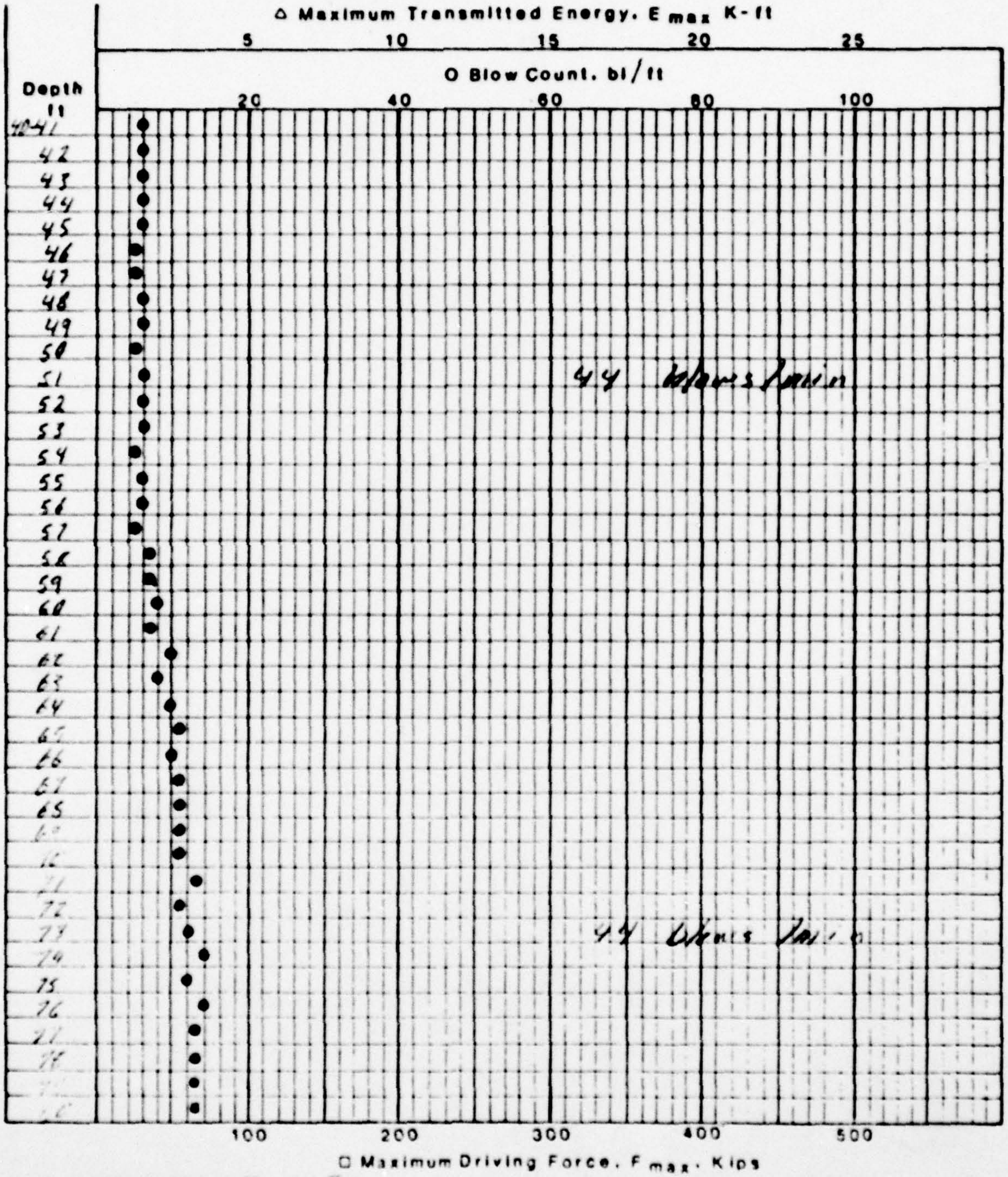
I.D. No. 09 02 150 10602

Date 11/29/75

Operator [illegible]

PILE DRIVING MEASUREMENTS
PILE NO. 06

	Time	Sequence No.
First		
Finish		



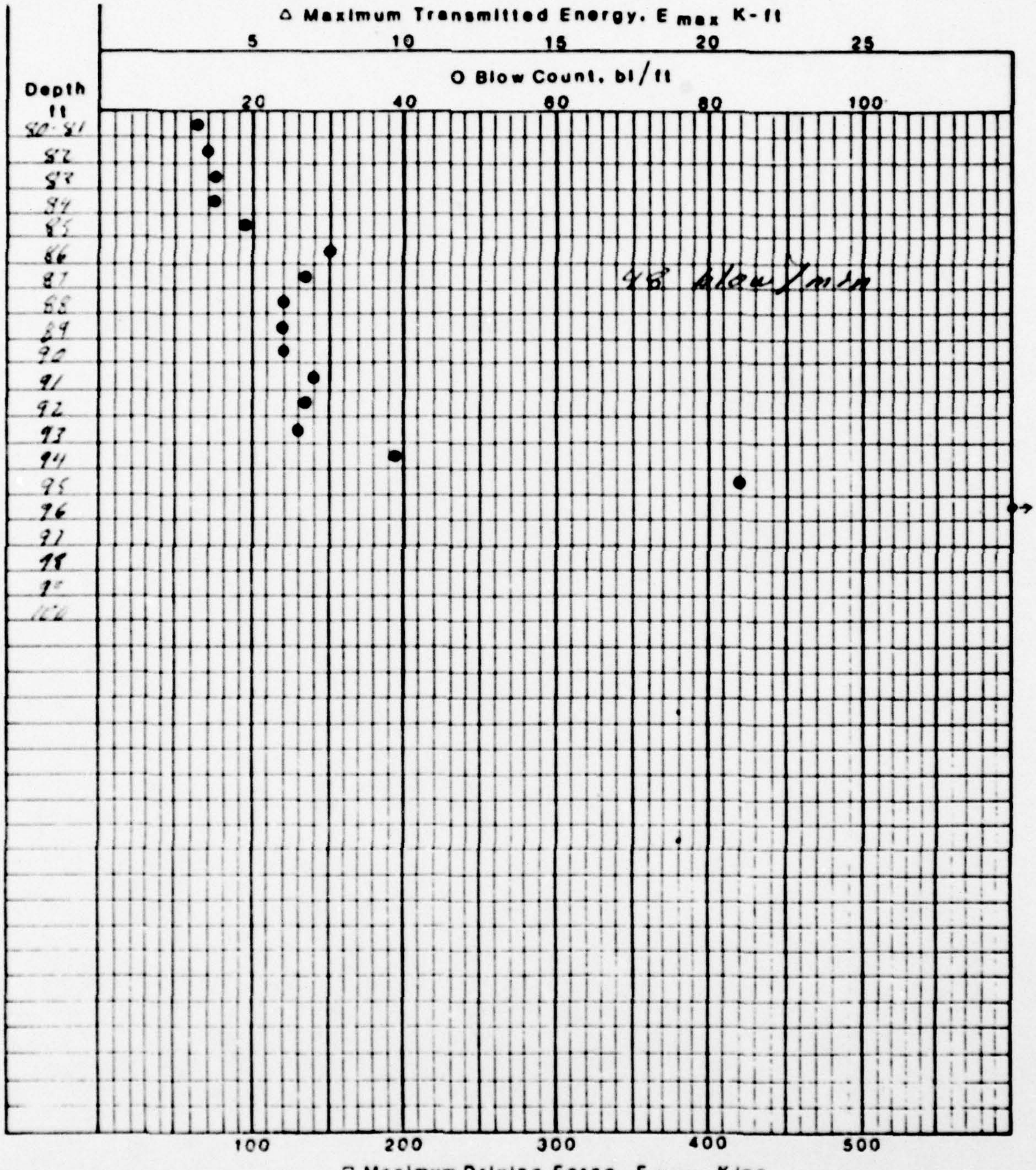
WCC. Y7C625. Phase IV, Vol. III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 1 0600
Date 1/29/79
Operator JSL

PILE DRIVING MEASUREMENTS
PILE NO. 06

	Time	Sequence No.
First		
Finish		



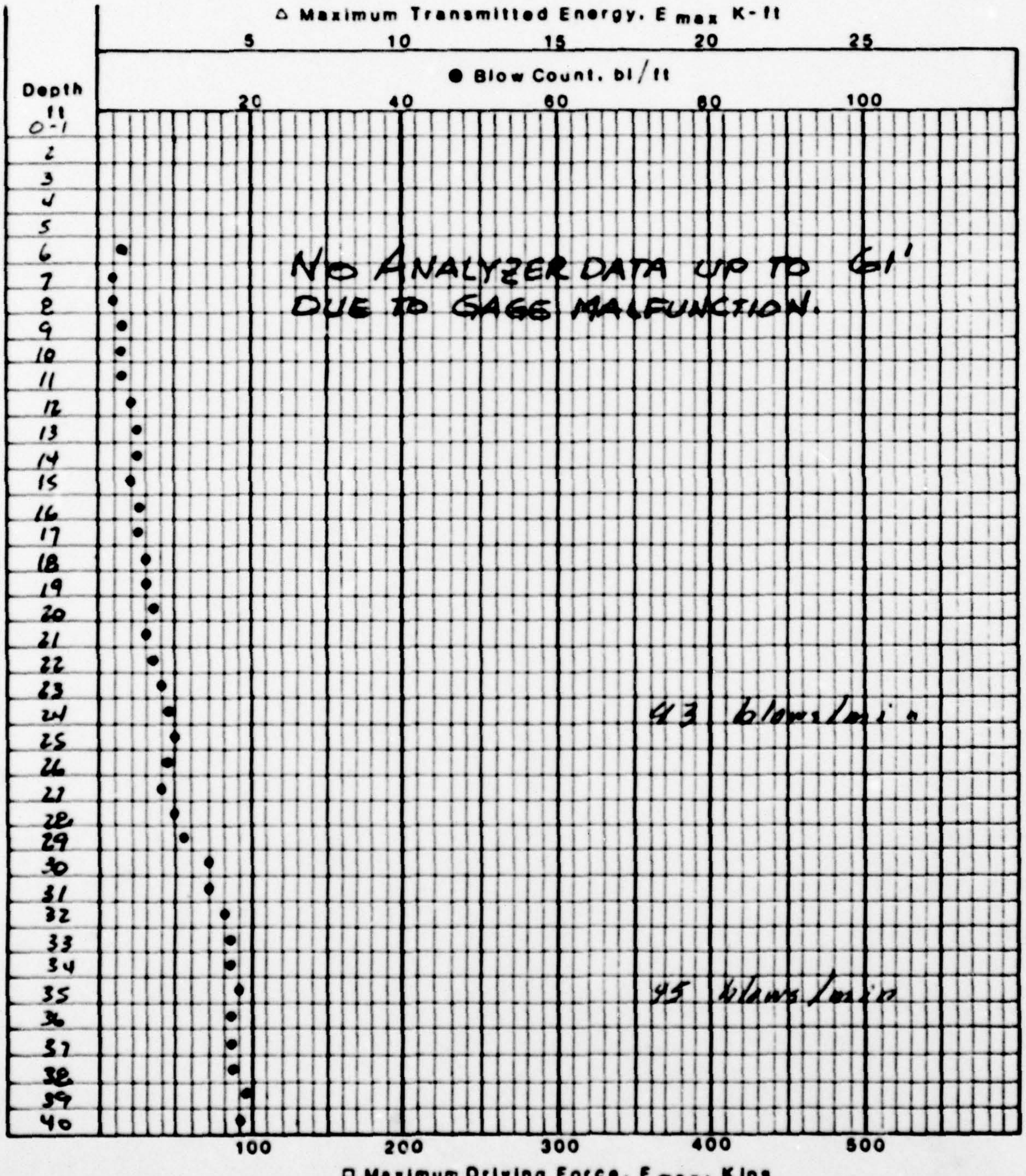
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09/02/180/1/0700
Date 1/30/79
Operator JC

PILE DRIVING MEASUREMENTS

PILE NO. 07
25 ft MZ

	Time	Sequence No.
First	19:50/30 JAN	0701
Finish	12:46/31 JAN	0708

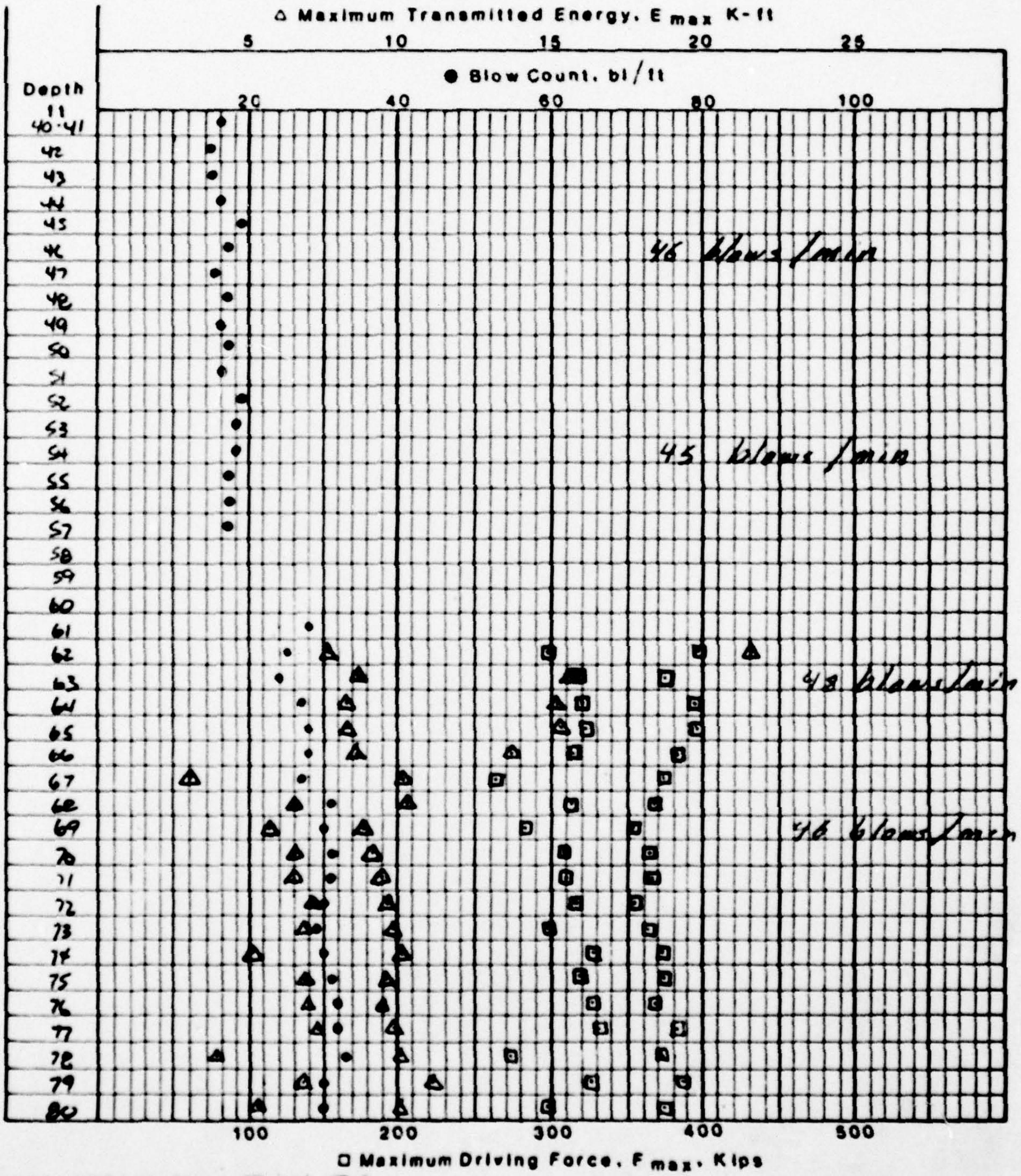


WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09/02/180/0/0700
Date 1/30-31/79
Operator JL/JGH

PILE DRIVING MEASUREMENTS
PILE NO. Ø7

	Time	Sequence No.
First		
Finish		



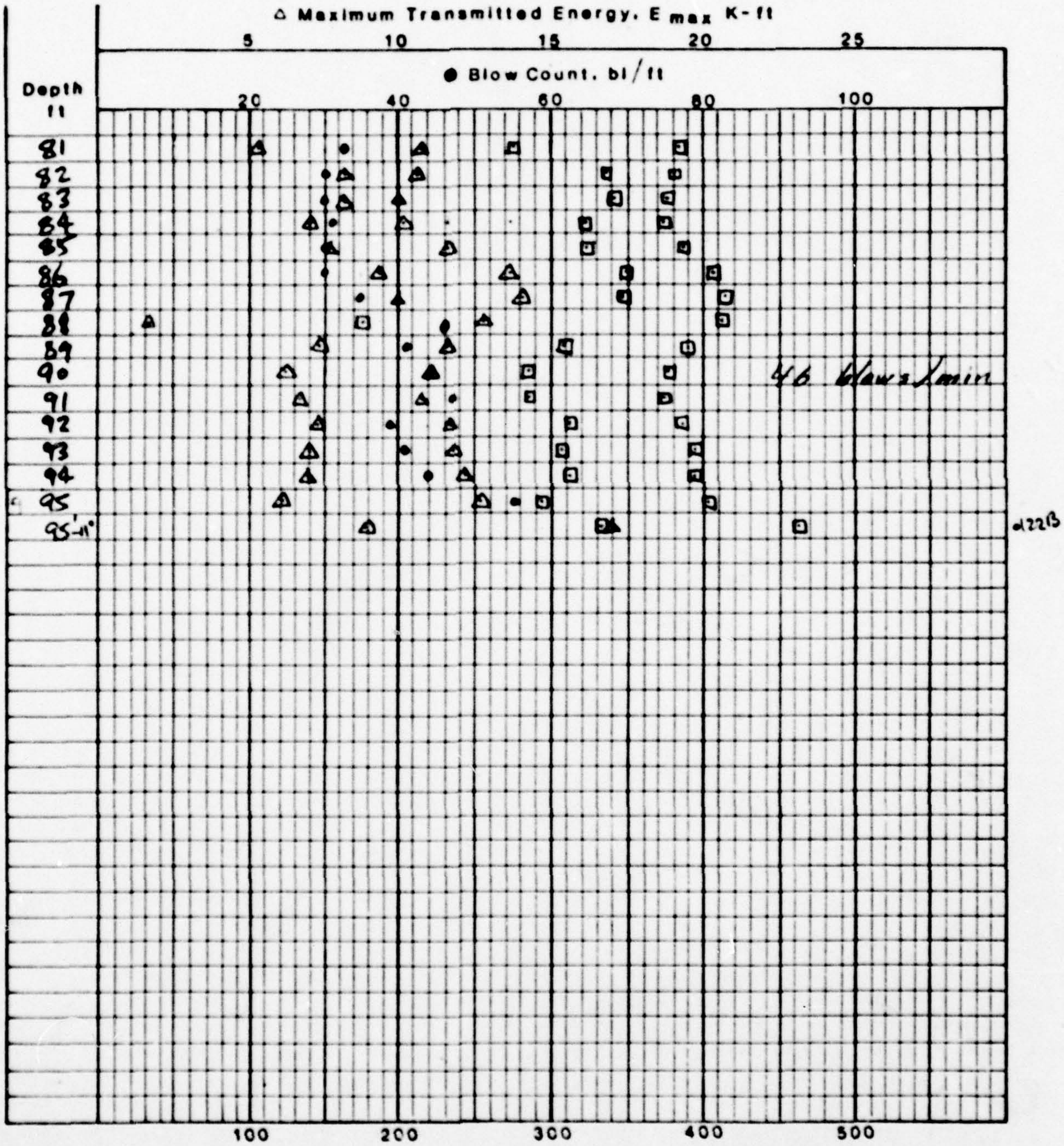
WCC, Y7C825, Phase IV; Vol. III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 0 0700
Date 1/31/79
Operator JL/JBH

PILE DRIVING MEASUREMENTS
PILE NO. 07

	Time	Sequence No.
First		
Finish		



WCC, Y7C825, Phase IV ; Vol III A

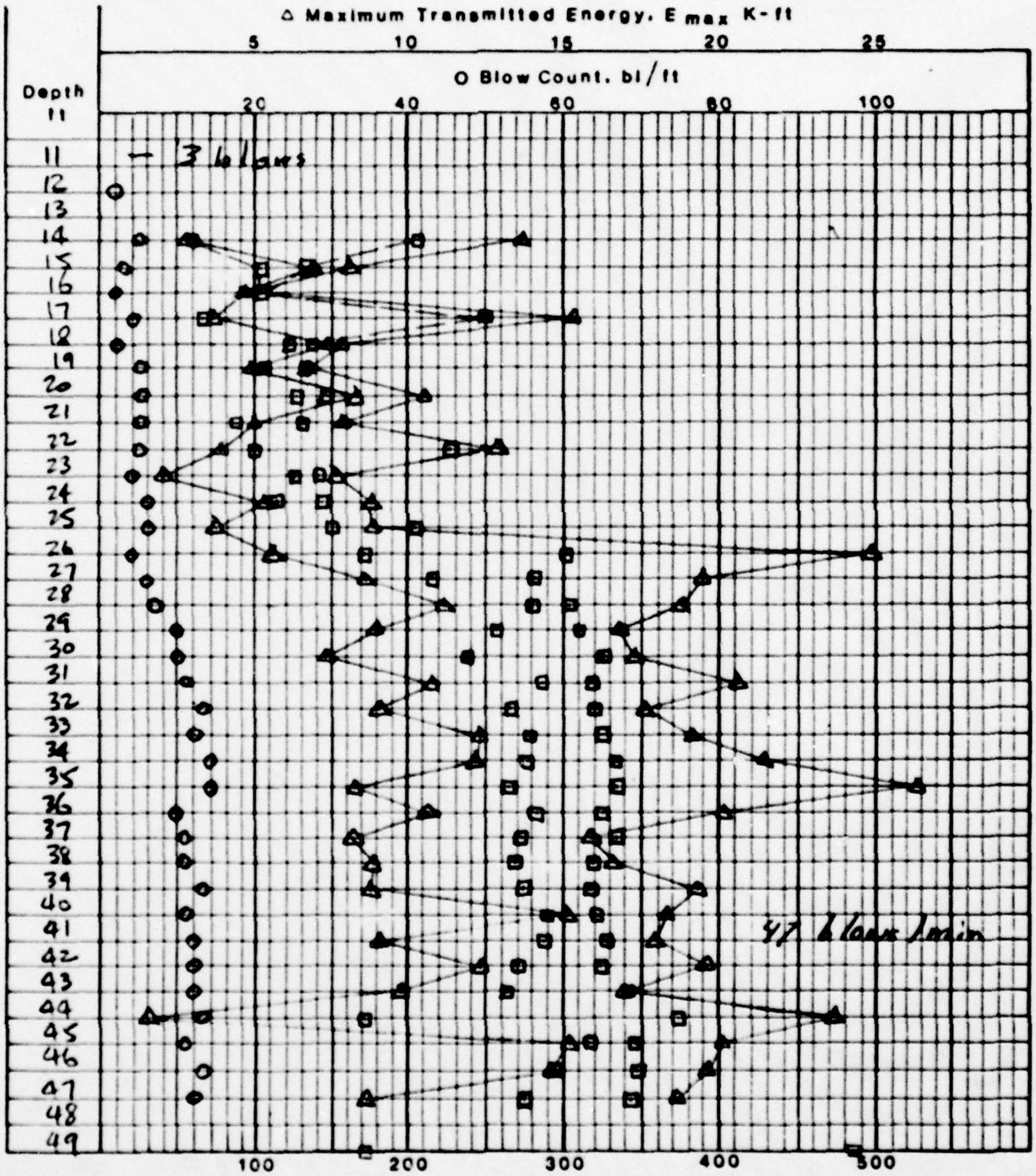
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 0 0800
Date 31 JAN 79
Operator JSL

PILE DRIVING MEASUREMENTS

PILE NO. 08
15 ft MZ

	Time	Sequence No.
First		0801
Finish		0806



WCC, Y7C825, Phase IV ; Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

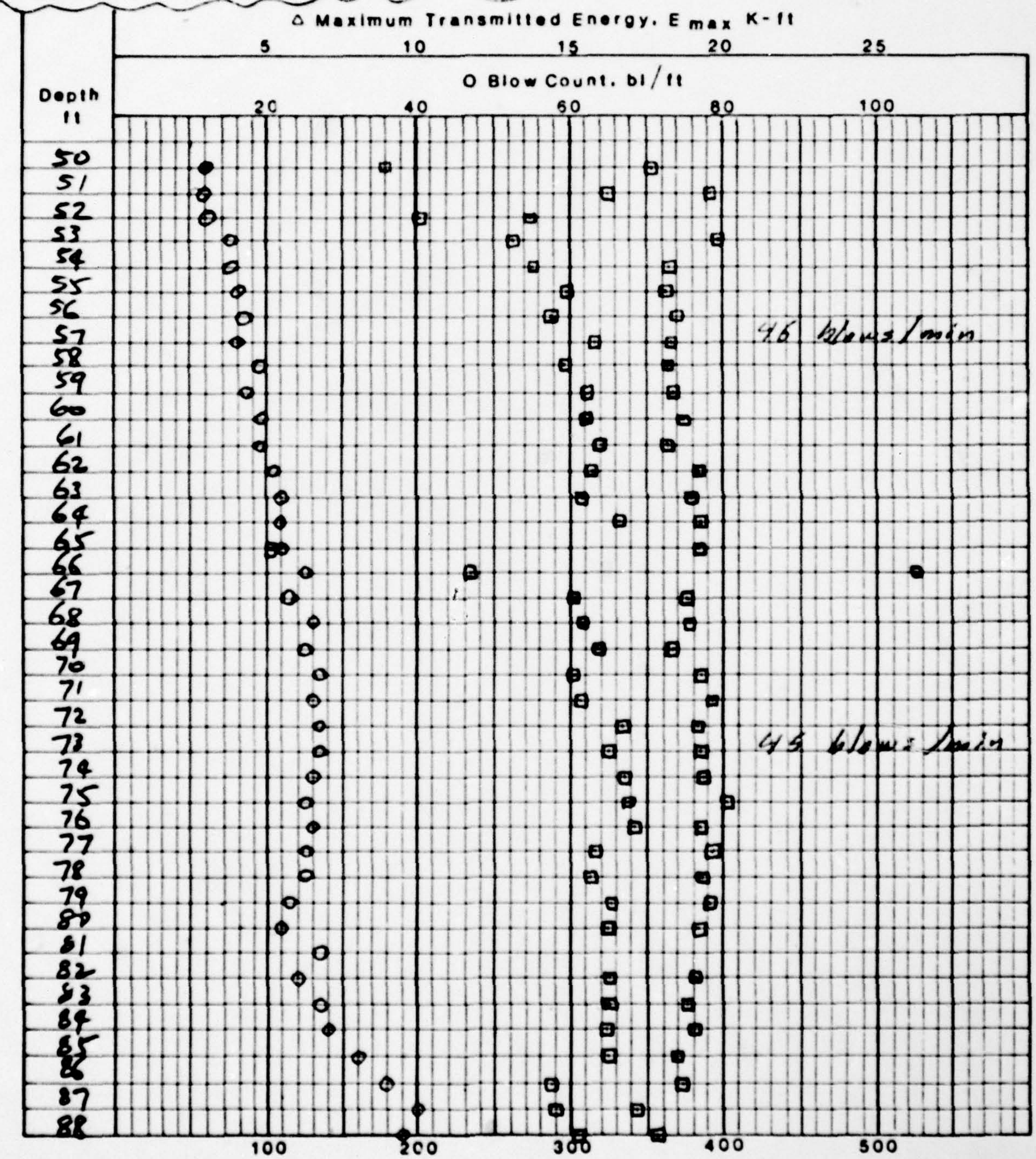
I.D. No. 09 02 180 0 0800
Date 1/31/79
Operator JSL

PILE DRIVING MEASUREMENTS

PILE NO. 08

NO ENERGY DATA FOLLOWING 48' DEPTH

	Time	Sequence No.
First		
Finish		

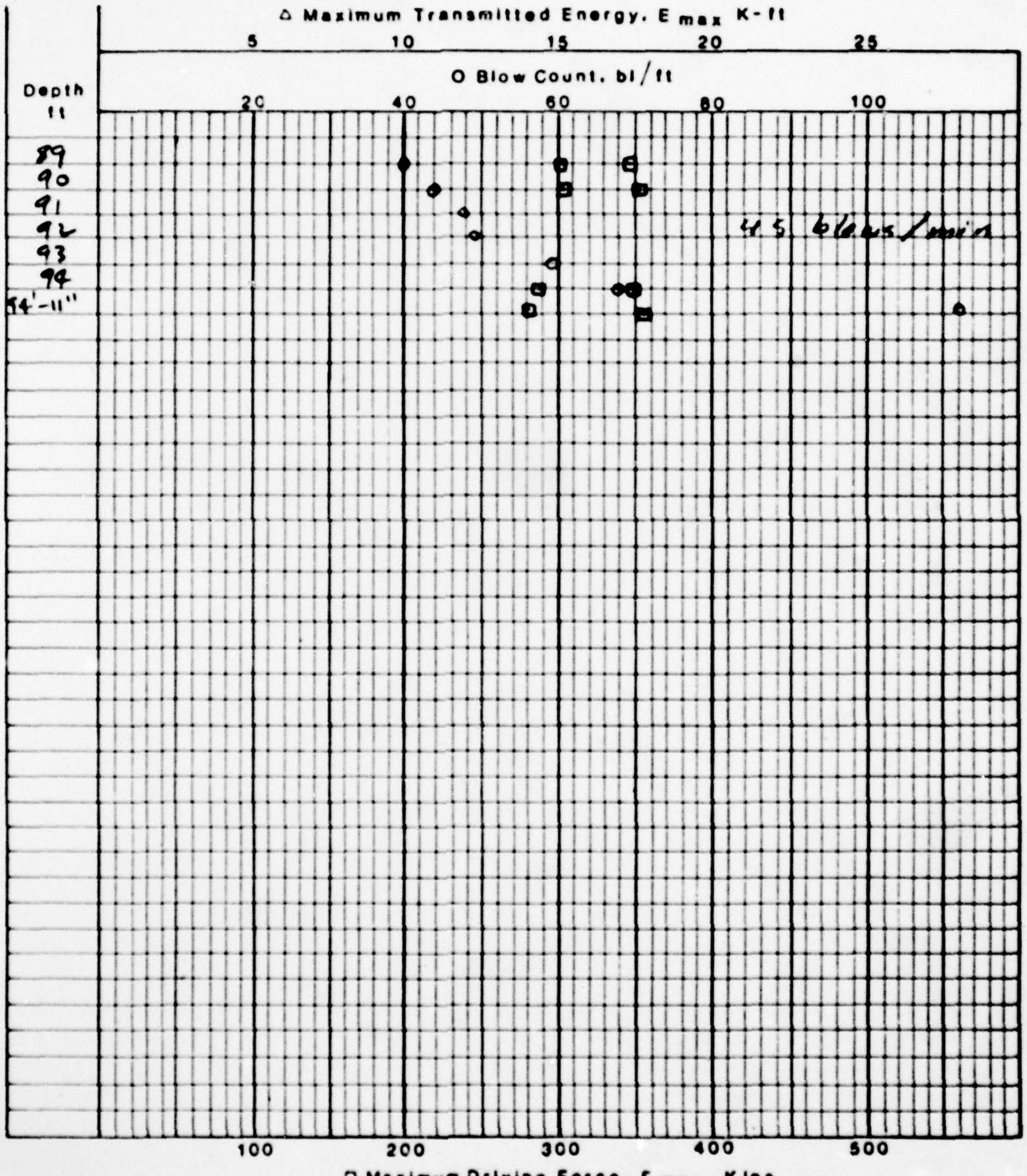


WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 0 0800
Date 1/31/79
Operator JSL

PILE DRIVING MEASUREMENTS
PILE NO. 08

	Time	Sequence No.
First		
Finish		

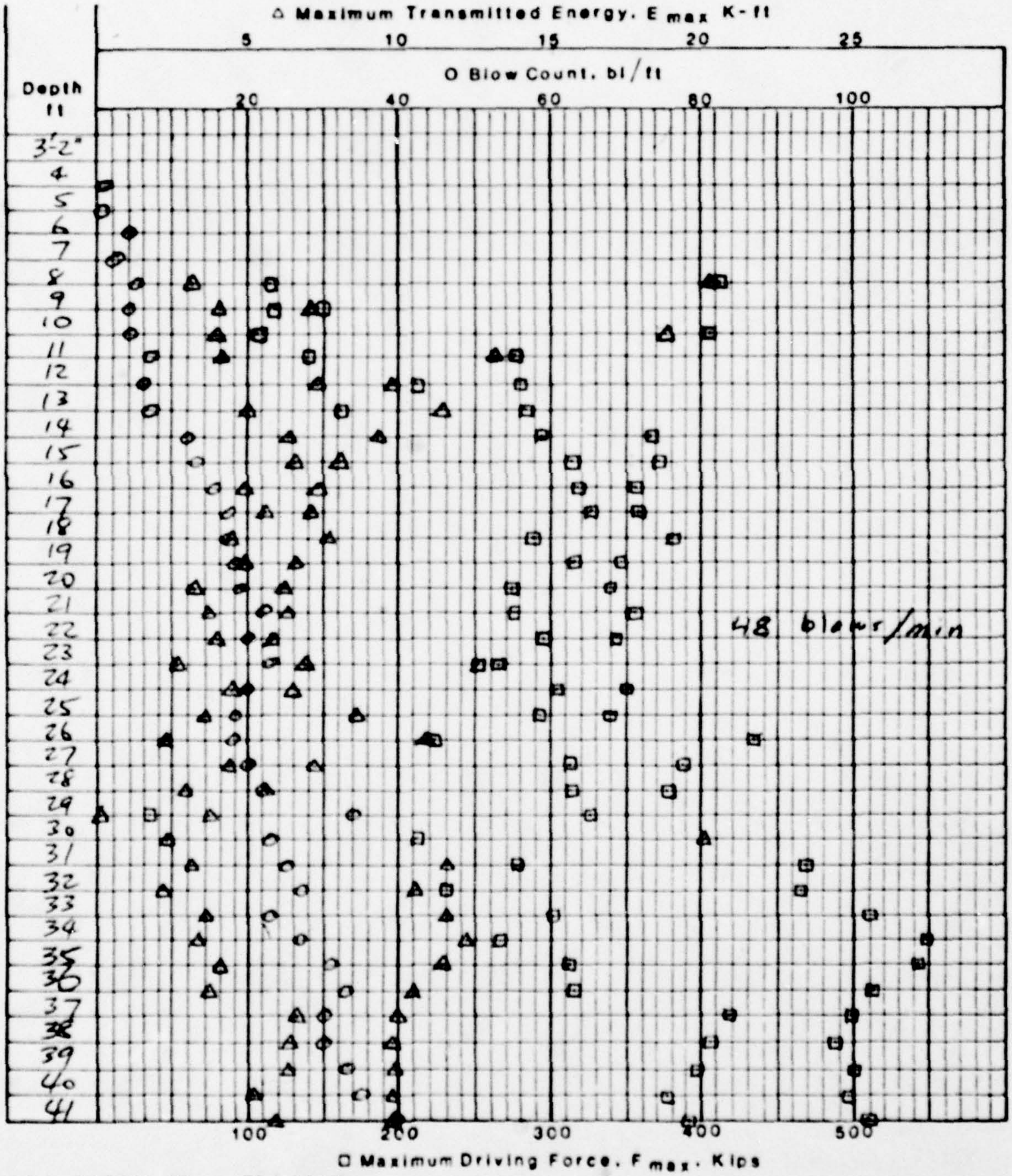


WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 0 1300
Date 2/8/79
Operator AZ

PILE DRIVING MEASUREMENTS
PILE NO. 13

	Time	Sequence No.
First	14:42	1301
Finish	15:21	1302



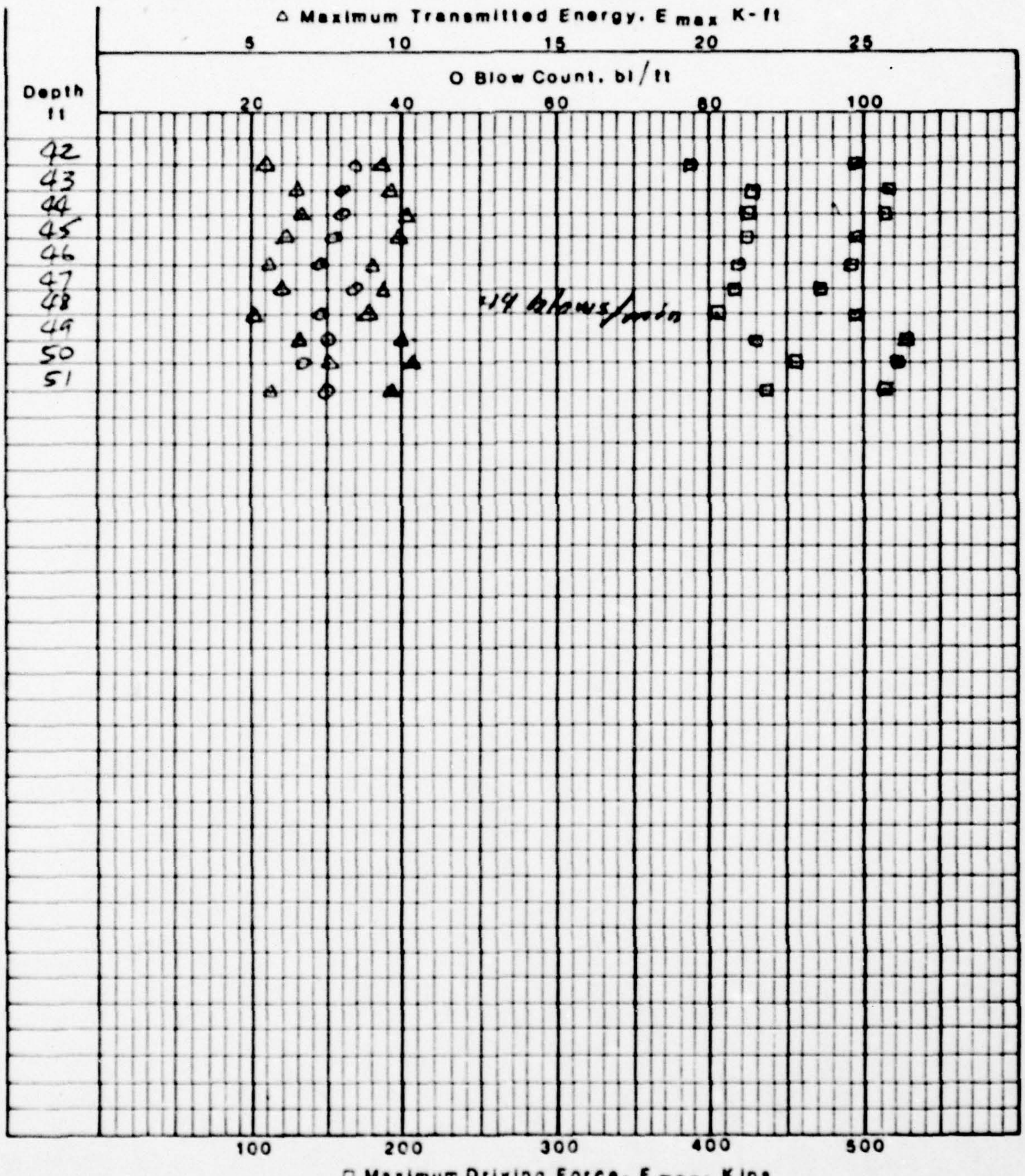
WCC, Y7C825, Phase IV ; Vol. III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 180 0 1300
Date 2/3/79
Operator AE

PILE DRIVING MEASUREMENTS
PILE NO. 13

	Time	Sequence No.
First		
Finish		



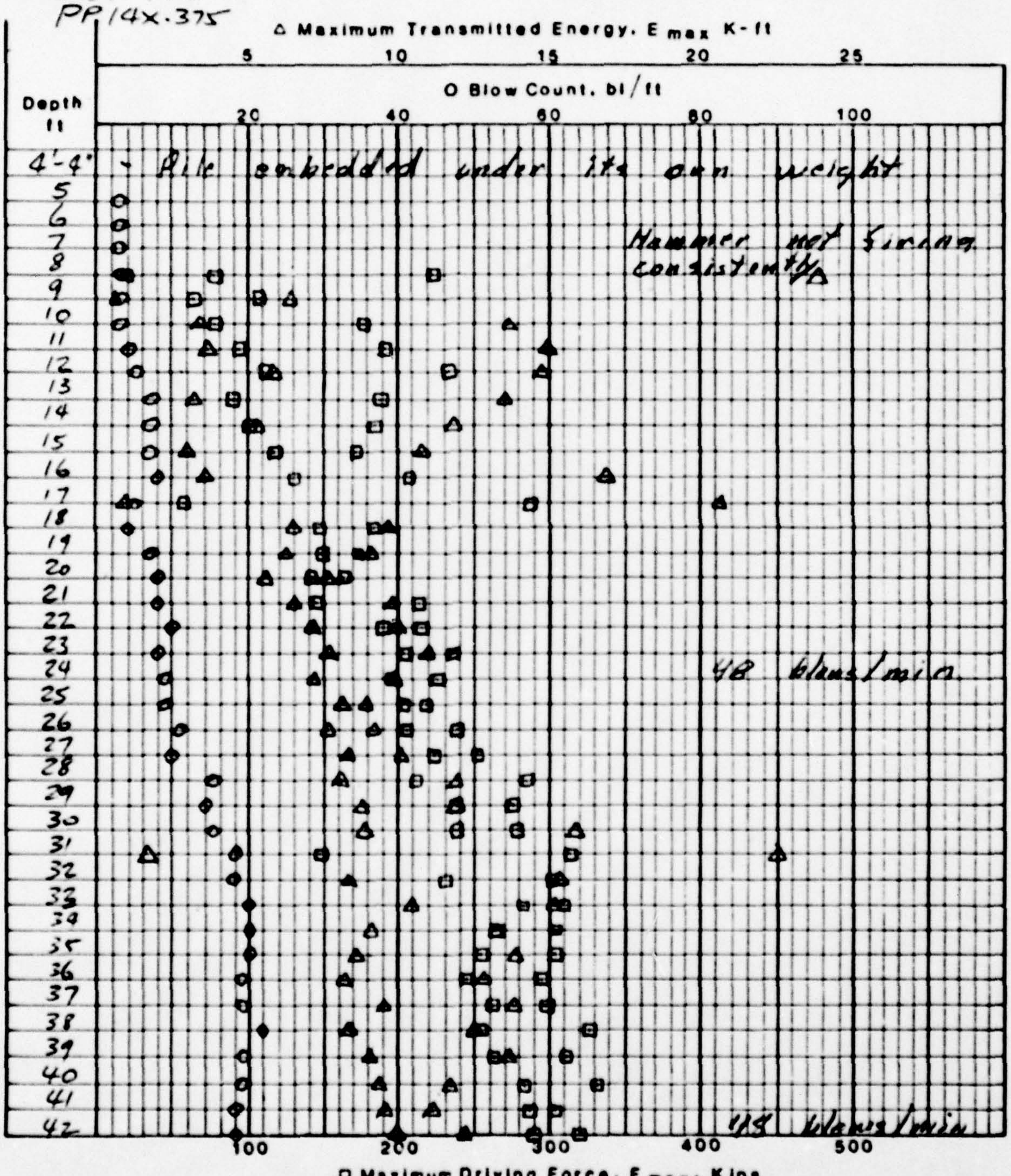
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 120 0 1400
Date 3 Feb 79
Operator JSL

PILE DRIVING MEASUREMENTS

PILE NO. 14
15 ft M2
PP 14x.375

	Time	Sequence No.
First	18:57	1401
Finish	19:55	1404



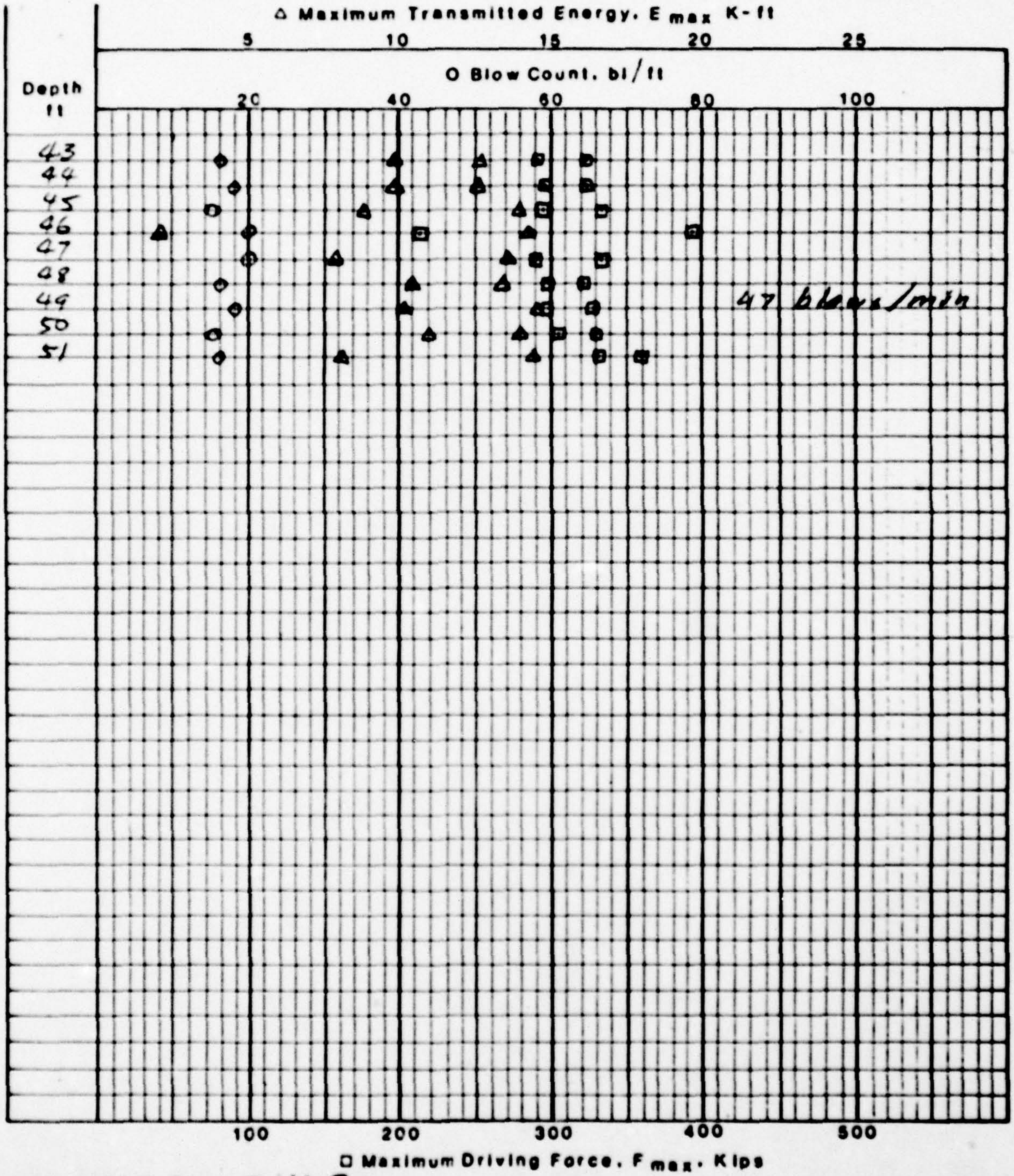
WCC. Y7C825. Phase IV ; Vol IIIA

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

I.D. No. 09 02 120 0 1400
Date 2/3/79
Operator JSL

PILE DRIVING MEASUREMENTS
PILE NO. 14

	Time	Sequence No.
First		
Finish		



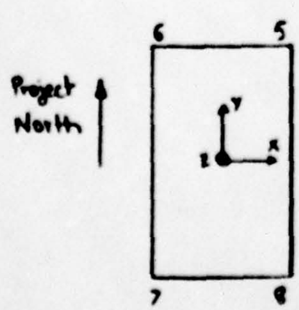
M.6 ABSOLUTE DISPLACEMENTS OF MONOLITH [illegible]

The absolute displacements of monolith during prototype pile driving, presented in Tables M.1a and M.1b are with respect to the position of monolith, axially loaded and laterally unloaded, before prototype pile driving.

The absolute displacements of monolith, presented in Table M.2 are with respect to initial monolith position before preloading (no load applied); therefore, these displacement values represent total monolith displacements throughout the tests.

318	239.3	48.1	0.825
1/26/03:18			0.800
372			0.864
1/26/13:57			0.889
382	238.8	47.6	0.904
1/26/20:06			0.878
395	239.3	48.0	0.942
1/27/03:09			0.918
459	238.8	48.2	0.998
1/27/13:37			0.962
475	239.0	47.9	1.060
1/27/20:51			1.021
481	239.3	48.1	1.133
1/28/07:01			1.093
486	239.0	48.4	1.180
1/29/14:30			1.117
494	238.5	47.8	1.310
1/29/19:25			1.261
507	238.8	48.4	1.374
1/30/02:12			1.329
535	239.5	48.1	1.504
1/30/18:20			1.466
550	239.0	48.2	1.566
1/30/22:49			1.353
614	238.8	48.3	1.622
1/31/13:32			1.564
623	239.8	48.3	1.670
1/31/18:27			1.601

Y-Component				Z-Component							Remarks
	7	8	$\bar{Y}$	6	6	56	7	8	78	$\bar{Z}$	
Optical Survey Data											
Corrected Cyber Data											
781	[illegible]	0.748	0.757	-0.050	-0.050	-0.065	+0.150	0.100	0.125	0.030	No measurement of reference
866	[illegible]	0.676	0.734								beam z displacement
761	[illegible]	0.745	0.757	-0.070	-0.070	0.070	0.100	0.080	0.090	0.010	
736	0.759	0.699	[illegible]	-0.053	[illegible]	-0.048	+0.057	0.033	0.035	0.018	
844	0.801	0.766	0.805	-0.070	-0.080	-0.075	0.090	0.060	0.075	0.000	
767	[illegible]	0.704	0.745	-0.013	-0.084	-0.033	0.071	0.066	0.069	-0.010	
794	0.825	0.754	0.785	-0.120	-0.120	[illegible]	0.110	0.070	0.090	-0.015	
744	0.789	0.734	0.753	-0.116	-0.100	-0.108	0.091	0.063	0.077	-0.016	
867	0.872	0.851	0.859	-0.130	-0.110	-0.120	0.090	0.050	0.070	-0.025	
812	0.843	0.774	0.807	-0.132	-0.112	-0.122	0.063	0.052	0.058	-0.032	
918	0.916	0.866	0.891								No vertical control. No load level
844	0.867	0.805	0.836								because printer inoperable
967	0.938	0.940	0.950	-0.170	-0.170	-0.170	-0.090	0.040	-0.095	-0.098	
891	0.943	0.866	0.894	-0.188	-0.169	-0.175	0.048	0.031	0.040	-0.068	
004	1.023	0.975	0.986	-0.200	-0.200	-0.200	0.030	-0.010	0.010	-0.095	
984	0.986	0.946	0.963	-0.217	-0.194	-0.206	0.008	0.000	0.004	-0.101	
053	1.053	1.035	1.043	-0.240	-0.260	-0.250	0.000	-0.060	-0.030	-0.140	
965	1.020	0.939	0.972	-0.255	-0.243	-0.249	-0.006	-0.015	-0.011	-0.130	
109	1.119	1.063	1.088	-0.270	-0.260	-0.265	0.000	-0.040	-0.020	-0.143	
032	1.057	0.981	1.023	-0.272	-0.259	-0.265	0.001	-0.009	-0.004	-0.135	
175	1.263	1.197	1.192	-0.340	-0.340	-0.340	-0.060	-0.090	-0.075	-0.208	
106	1.179	1.108	1.121	-0.363	-0.337	-0.350	-0.057	-0.066	-0.061	-0.206	
228	1.302	1.245	1.239	-0.410	-0.400	-0.405	-0.070	-0.120	-0.095	-0.250	
151	1.241	1.172	1.170	-0.411	-0.402	-0.406	-0.064	-0.074	-0.069	-0.238	
348	1.397	1.363	1.355	-0.480	-0.500	-0.490	-0.120	-0.190	-0.155	-0.323	
281	1.323	1.251	1.279	-0.512	-0.492	-0.502	-0.139	-0.142	-0.140	-0.321	
421	1.479	1.415	1.422	-0.530	-0.550	-0.540	-0.120	-0.190	-0.155	-0.348	
352	1.372	1.267	1.330	-0.547	-0.533	-0.540	-0.146	-0.160	-0.153	-0.346	
556	1.584	1.525	1.542	-0.650	-0.650	-0.650	-0.210	-0.260	-0.235	-0.443	
475	1.487	1.407	1.459	-0.675	-0.648	-0.661	-0.233	-0.238	-0.235	-0.448	
635	1.694	1.627	1.631	-0.690	-0.710	-0.700	-0.230	-0.290	-0.260	-0.480	
557	1.578	[illegible]	[illegible]	-0.699	-0.685	-0.692	-0.286	-0.273	-0.279	-0.486	
696	1.730	1.679	1.682	-0.780	-0.770	-0.775	-0.260	-0.340	-0.300	-0.538	
580	1.635	[illegible]	1.584	-0.750	-0.729	-0.740	-0.323	-0.303	-0.313	-0.526	
729	1.798	1.731	1.735	-0.780	-0.800	-0.790	-0.270	-0.340	-0.305	-0.548	
631	1.688	1.615	1.634	-0.786	-0.771	-0.778	-0.338	-0.318	-0.328	-0.553	
799	1.831	1.782	1.790	-0.870	-0.880	-0.875	-0.320	-0.390	-0.355	-0.615	
724	1.772	1.681	1.720	-0.899	-0.872	-0.856	-0.357	-0.378	-0.367	-0.626	



1

2

PILE DRIVING EFFECTS TEST PROGRAM

ABSOLUTE DISPLACEMENTS OF MONOLITH M2 DURING PROTOTYPE PILE DRIVING

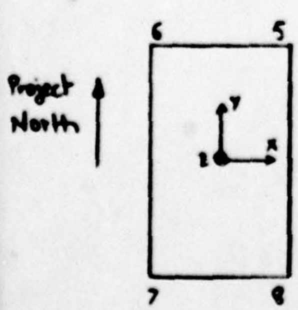
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.

Woodward-Clyde Consultants

Table M.1a

0907	781	236.3	[illegible]	2.08[illegible]	2.1[illegible]	2.115	2.058	2.110
2/1/23:10	2/02/00:33			2.019	2.051	2.058	1.965	2.023
1003	782	238.5	48.4	2.119	2.251	2.269	2.140	2.199
2/2/08:[illegible]	2/02/08:34			2.089	2.117	2.082	2.002	2.072
1003	782	238.2	48.5	2.188	2.313	2.366	2.228	2.274
2/2/11:00	2/02/11:27			2.106	2.141	2.228	2.094	2.142
1005	4	240.0	48.4	2.322	2.450	2.454	2.343	2.392
2/2/12:30	2/02/14:26			2.267	2.286	2.333	2.223	2.277
1200	10	239.0	47.8			2.526	2.385	
2/2/19:30	2/02/19:41					[illegible]	2.254	
1202	20	239.5	48.3	2.415	2.541	2.566	2.461	2.496
2/3/02:10	2/03/01:57			2.337	2.356	2.423	2.307	2.356
1300	74	239.8	48.7	2.487	2.556	2.572	2.459	2.498
2/3/07:30	2/03/14:41			2.323	2.342	2.413	2.311	2.347
1302	80	239.3	48.2	2.467	2.610	2.652	2.543	2.568
2/3/17:30	2/03/18:05			2.428	2.445	2.481	2.375	2.432
1404	92	238.8	47.7	2.613	2.788	2.833	2.693	2.732
2/3/20:35	2/03/21:00			2.591	2.612	2.664	2.550	2.604
1408	105	238.5	0.6	1.779	1.808	1.857	1.821	1.816
2/4/01:20	2/04/02:01			1.690	1.698	1.771	1.693	1.713

Y-Component			Z-Component							Remarks
7	8	Ȳ	5	6	56	7	8	78	Z̄	
Optical Survey Data										
Corrected Cyber Data										
1.839	1.823	1.842	-0.920	-0.950	-0.935	-0.340	-0.410	-0.375	-0.655	
1.814	1.758	1.732	-0.935	-0.904	-0.919	-0.361	-0.383	-0.372	-0.646	
2.115	2.058	2.110	-1.180	-1.160	-1.170	-0.460	-0.580	-0.520	-0.845	
2.052	1.965	2.023	-1.180	-1.131	-1.156	-0.503	-0.551	-0.527	-0.842	
2.259	2.140	2.199	-1.230	-1.210	-1.220	-0.500	-0.620	-0.560	-0.810	
2.055	2.102	2.078	-1.239	-1.178	-1.209	-0.542	-0.588	-0.565	-0.887	
2.366	2.182	2.274	-1.260	-1.280	-1.270	-0.500	-0.620	-0.560	-0.915	
2.228	2.094	2.162	-1.235	-1.182	-1.209	-0.543	-0.592	-0.567	-0.862	
2.454	2.343	2.392	-1.400	-1.390	-1.395	-0.540	-0.680	-0.610	-1.003	
2.333	2.223	2.277	-1.357	-1.390	-1.373	-0.573	-0.634	-0.604	-0.963	
2.526	2.385									No readings of Y5, Y6
2.315	2.284									No vertical survey.
2.566	2.461	2.496	-1.450	-1.420	-1.435	-0.610	-0.720	-0.665	-1.050	
2.423	2.307	2.356	-1.500	-1.438	-1.467	-0.604	-0.655	-0.630	-1.048	
2.512	2.459	2.498	-1.440	-1.420	-1.430	-0.600	-0.740	-0.670	-1.050	
2.413	2.311	2.347	-1.456	-1.385	-1.421	-0.618	-0.677	-0.647	-1.034	
2.652	2.543	2.568	-1.530	-1.490	-1.510	-0.600	-0.760	-0.680	-1.095	
2.481	2.375	2.432	-1.469	-1.400	-1.435	-0.618	-0.676	-0.647	-1.041	
2.833	2.693	2.732	-1.570	-1.500	-1.535	-0.610	-0.770	-0.690	-1.113	
2.664	2.550	2.604	-1.527	-1.436	-1.482	-0.630	-0.709	-0.670	-1.076	
1.857	1.821	1.816	-1.490	-1.430	-1.460	-0.740	-0.900	-0.820	-1.140	After removal of lateral load
1.771	1.693	1.712	-1.454	-1.371	-1.412	-0.772	-0.842	-0.807	-1.110	



1 2

PILE DRIVING EFFECTS TEST PROGRAM

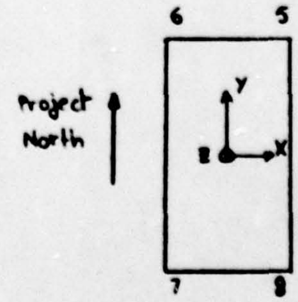
ABSOLUTE DISPLACEMENTS OF MONOLITH M2 DURING PROTOTYPE PILE DRIVING

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Table M.1 b

Displacements	Horizontal displacement, in. 5	6	7	8	Average	5	
	Reference point data						
	Corrected linear potentiometer d						
at the end of preloading (monolith only laterally unloaded)	0.467	0.464	0.428	0.441	0.450	0.220	0.
	0.485	0.428	0.482	0.555	0.488	0.176	0.
prior to prototype pile driving (monolith axially and laterally loaded)	1.209	1.253	1.222	1.183	1.217	0.300	0.
	1.214	1.174	1.245	1.251	1.221	0.228	0.
at the end of prototype pile driving (monolith axially and laterally loaded)	3.080	3.252	3.261	3.134	3.182	1.790	1.
	3.076	3.040	3.146	3.105	3.092	1.703	1.
prior to load testing (monolith axially loaded and laterally unloaded)	2.178	2.214	2.253	2.198	2.211	1.700	1.
	2.175	2.126	2.252	2.248	2.201	1.630	1.



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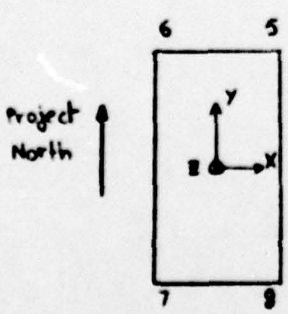
...ntal displacement, in.			Settlement, in.						
7	8	Average	5	6	North Average	7	8	South Average	Average
Reference point data									
Corrected linear potentiometer data									
0.428	0.441	0.450	0.220	0.170	0.195	0.100	0.170	0.135	0.165
0.482	0.555	0.488	0.176	0.089	0.132	0.114	0.150	0.132	0.132
1.222	1.183	1.217	0.300	0.220	0.260	-0.050	0.070	0.010	0.135
1.245	1.251	1.221	0.228	0.133	0.180	0.029	0.070	0.050	0.115
3.261	3.134	3.182	1.790	1.670	1.730	0.710	0.940	0.825	1.278
3.146	3.105	3.092	1.703	1.525	1.614	0.744	0.859	0.802	1.208
2.253	2.198	2.211	1.700	1.590	1.645	0.850	1.070	0.960	1.303
2.252	2.248	2.201	1.630	1.460	1.544	0.889	1.000	0.945	1.244



1 2

PILE DRIVING EFFECTS TEST PROGRAM

ABSOLUTE DISPLACEMENTS OF MONOLITH M 2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0006

Woodward-Clyde Consultants
VTC020 Phase II ; Vol. IIA

Table M.2

Y7C-825
Phase IV ; VOL III A

M.7 INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR PROTOTYPE PILES OF MONOLITH M2

Monoliths M2/6, Prototype Pile No. 1, Pile Type HP 14x73
Final Pile Penetration

Sequence No		0101			0102			0103			0104			0105			0106			0107			0108			0109			0110		
Pile Penetration ft		10.5'			20'			30			40			51			60			70			80			90			102		
Location Box Channel	Geophone No	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
✓ 1	M1		V			V			V			V			V			V			V			V			V			V	
✓ 2	G12-1		V	X		V	X		V	X		V	X		V	X		V	X		V	X		V	X		V	X		V	X
✓ 3	M2																														
✓ 4	G12-15																														
✓ 5	M3																														
✓ 6	G12-50																														
✓ 7	F3			X			X			X			X			X			X			X			X			X			X
✓ 8	G5-50		X			X			X			X			X			X			X			X			X			X	
✓ 9	F5			X			X			X			X			X			X			X			X			X			X
✓ 10	G5-15		X			X			X			X			X			X			X			X			X			X	
✓ 11	F4			X			X			X			X			X			X			X			X			X			X
✓ 12	G5-1 (F2)		X			X			X			X			X			X			X			X			X			X	
✓ 13	G11-1		X			X			X			X			X			X			X			X			X			X	
✓ 14	G4-1 (F1)																														
✓ 15	G11-15																														
✓ 16	G4-15																														
✓ 17	G11-50																														
✓ 18	G4-50																														

Monoliths M2/6, Prototype Pile No. 2, Pile Type HP 14x73
Final Pile Penetration 96 ft

Sequence No		0201			0202			0203			0204			0205			0206			0207			0208			end					
Pile Penetration ft		5			20			30			46			51			60			75			90			96					
Location Box Channel	Geophone No	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		V			V			V			V			V			V			V			V							
2	G12-1		V	X		V	X		V	X		V	X		V	X		V	X		V	X		V	X						
3	M2																														
4	G12-15																														
5	M3																														
6	G12-50																														
7	F3			X			X			X			X			X			X			X			X						
8	G5-50		X			X			X			X			X			X			X			X							
9	F5			X			X			X			X			X			V			X			X						
10	G5-15		X			X			X			X			X			X			X			X							
11	F4			X			X			X			X			X															
12	G5-1		X			X			X			X			X			X			X			X							
13	G11-1		X			X			X			X			X			X			X			X							
14	G4-1																		X			X			X						
15	G11-15																														
16	G4-15																														
17	G11-50																														
18	G4-50																														

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component

SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM
INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITHS M2/6 PROTOTYPE PILES No. 1 and 2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0000

Woodward-Clyde Consultants
WCC Phase II, Vol. IIIA

Monoliths M2/6, Prototype Pile No. 3 Pile Type HP 14x73
Final Pile Penetration 95.1 ft

Sequence No.		0301			0302			0303			0304			0305			0306		
Pile Penetration ft		5'10"			15'6"			35			56			70			85		
Junction Box Channel	Geophone No.	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		V			V			V			V			V			V	
2	G12-1		V	X		V	X		V	X		V	X		V	X		V	X
3	M2																		
4	G12-15																		
5	M3																		
6	G12-50																		
7	F3			X			X			X			X			X			X
8	G5-50		X			X			X			X			X			X	
9	F5			X			X			X			X			X			X
10	G5-15		X			X			X			X			X			X	
11	F4										G3-16								
12	G5-1		X			X			X			X			X			X	
13	G11-1		X			X			X			X			X			X	
14	G4-1			X			X			X			X			X			X
15	G11-15																		
16	G4-15																		
17	G11-50																		
18	G4-50																		

Monoliths M2/6, Prototype Pile No. 4, Pile Type HP14x73
Final Pile Penetration 95.4 ft

Sequence No.		0401			0402			0403			0404			0405		
Pile Penetration ft		3'6"			20			40			57			75		
Junction Box Channel	Geophone No.	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA	Osc	Tape	SA
1	M1		V			V			V			V			V	
2	G12-1		V	X		V	X		V	X		V	X		V	X
3	M2															
4	G12-15															
5	M3															
6	G12-50															
7	F3			X			X			X			X			X
8	G5-50		X			X			X			X			X	
9	F5			X			X			X			X			X
10	G5-15		X			X			X			X			X	
11	G3-15															
12	G8-1		X			X			X			X			X	
13	G11-1		X			X			X			X			X	
14	G4-1			X			X			X			X			X
15	G11-15															
16	G4-15															
17	G11-50															
18	G4-50															

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component

SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITHS M2/6 PROTOTYPE PILES No. 3 and 4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0000

Woodward-Clyde Consultants

77C000 Phase III; VOL III A

Monoliths M2/6, Prototype Pile No. 5 Pile Type HP 14x73
Final Pile Penetration 95.6 ft

Sequence No.		0501			0502			0503			0504					
Pile Penetration ft		7'10"			51'6"			56'7"			80			95'7"		
Junction Box Channel	Geophone No.															
1	M1		V			V			V			V				
2	G12-1		V	X		V	X		V	X		V	X			
3	M2															
4	G12-15															
5	M3															
6	G12-50															
7	F3			X			X			X			X			
8	G5-50		X			X			X			X				
9	F5			X			X			X			X			
10	G5-15		X			X			X			X				
11	G4-15							F4		X			X			
12	G5-1		X			X			X			X				
13	G11-1		X			X			X			X				
14	G4-1			X			X									
15	G11-15															
16	G4-15															
17	G11-50															
18	G4-50															

Monoliths M2/6, Prototype Pile No. 6 Pile Type HP 14x73
Final Pile Penetration 95 ft

Sequence No.		0601			0602			0603			0604			0605			0606			0607											
Pile Penetration ft		4			15			25			35			45			56			80			95'1/2"								
Junction Box Channel	Geophone No.																														
1	M1		V			V			V			V			V			X			X										
2	G12-1		V	X		V	X		V	X		V	X		V	X															
3	M2																	X			X										
4	G12-15																														
5	M3																	X			X										
6	G12-50																														
7	F3			X			X			X			X			X			X			X									
8	G5-50		X			X			X			X			X			V	X		V	X									
9	F5			X			X			X			X			X															
10	G5-15		X			X			X			X			X			V	X		V	X									
11	F4			X			X			X			X			X															
12	G5-1		X			X			X			X			X			X			X										
13	G11-1		X			X			X			X			X																
14	G4-1																		X			X									
15	G11-15																														
16	G4-15																														
17	G11-50																														
18	G4-50																														

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component

SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITHS M2/6 PROTOTYPE PILES No. 5 and 6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-79-C-0005

Woodward-Clyde Consultants

WCC Phase II; Vol. III A

Monoliths M2/6, Prototype Pile No. 7 Pile Type HP 14x73
Final Pile Penetration 94.9 ft

Sequence No.		0701			0702			0703			0704			0705			0706			0707			0708					
Pile Penetration ft		5			20			30			40			50			57'10"			66'			86'			94'11"		
Junction Box Channel	Geophone No.	Tape	Osc.	PVM	Tape	Osc.	PVM	Tape	Osc.	PVM	Tape	Osc.	PVM	Tape	Osc.	PVM	Tape	Osc.	PVM	Tape	Osc.	PVM	Tape	Osc.	PVM	Tape	Osc.	PVM
1	M1		X			X			X			X			X			X			V			V				
2	G12-1																				V	X		V	X			
3	M2		X			X			X			X			X			X										
4	G12-15																											
5	M3		X			X			X			X			X			X										
6	G12-50																											
7	F3			X			X			X			X			X			X			X			X			
8	G5-50		V	X		V	X		V	X		V	X		V	X		V	X		X			X				
9	F5																					X			X			
10	G5-15		V	X		V	X		V	X		V	X		V	X		V	X		X			X				
11	F4																											
12	G5-1		X			X			X			X			X			X			X			X				
13	G11-1																				X			X				
14	G4-1			X			X			X			X			X			X			X			X			
15	G11-15																											
16	G4-15																											
17	G11-50																											
18	G4-50																											

Monoliths M2/6, Prototype Pile No 8 Pile Type HP 14x73
Final Pile Penetration 94.9 ft

Sequence No.		0801			0802			0803			0804			0805			0806			end of pile		
Pile Penetration ft		3.5			25			43			47			65			80			94'11"		
Junction Box Channel	Geophone No.	Tape	Osc.	PVM	Tape	Osc.	PVM	Tape	Osc.	PVM	Tape	Osc.	PVM	Tape	Osc.	PVM	Tape	Osc.	PVM	Tape	Osc.	PVM
1	M1		V			V			V			V			V			V				
2	G12-1		V	X		V	X		V	X		V	X		V	X		V	X			
3	M2																					
4	G12-15																					
5	M3																					
6	G12-50																					
7	F3			X			X			X			X			X			X			
8	G5-50		X			X			X			X			X			X				
9	F5			X			X			X			X			X			X			
10	G5-15		X			X			X			X			X			X				
11	F4																					
12	G5-1		X			X			X			X			X			X				
13	G11-1		X			X			X			X			X			X				
14	G4-1			X			X			X			X			X			X			
15	G11-15																					
16	G4-15																					
17	G11-50																					
18	G4-50																					

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

- X all 3 components
- T x component
- L y component
- V z component

SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITHS M2/6 PROTOTYPE PILES No. 7 and 8

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-79-C-0005

Woodward-Clyde Consultants

WCC Phase III, Vol III A

Monoliths M2/6, Prototype Pile No. 9, Pile Type HP 14x73
Final Pile Penetration [illegible]

Sequence No.		0901			0902			0903			0904			0905			0906			0907			end of pile								
Pile Penetration ft		2'2'			21'			35			47			60			75			90			95'								
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	M1		V			X			V			V			V			V			V										
2	G12-1		V	X		V	X		V	X		V	X		V	X		V	X		V	X									
3	M2					X																									
4	G12-15																														
5	M3					X																									
6	G12-50																														
7	F3			X			X			X			X			X			X			X									
8	G5-50		X						X			X			X			X			X										
9	F5			X			X			X			X			X			X			X									
10	G5-15		X						X			X			X			X			X										
11	F4																														
12	G5-1		X			X			X			X			X			X			X										
13	G11-1		X			V			X			X			X			X			X										
14	G4-1			X			X			X			X			X			X			X									
15	G11-15																														
16	G4-15																														
17	G11-50																														
18	G4-50																														

Monoliths M2/6, Prototype Pile No. 10, Pile Type HP 14x73
Final Pile Penetration 94.5 ft

Sequence No.		1001			1002			1003			1004			1005		
Pile Penetration ft		9			24'6"			40			51			75		
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	M1		V			V			V			V			V	
2	G12-1		V	X		V	X		V	X		V	X		V	X
3	M2															
4	G12-15															
5	M3															
6	G12-50															
7	F3			X			X			X			X			X
8	G5-50		X			X			X			X			X	
9	F5			X			X			X			X			X
10	G5-15		X			X			X			X			X	
11	F4															
12	G5-1		X			X			X			X			X	
13	G11-1		X			X			X			X			X	
14	G4-1			X			X			X			X			X
15	G11-15															
16	G4-15															
17	G11-50															
18	G4-50															

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

- X all 3 components
- T x component
- L y component
- V z component

SA or PVM : Peak Vibration Monitor
Osc. : Oscillograph
Tape : Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITHS M2/6 PROTOTYPE PILES No. 9 and 10

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-79-C-0008

Woodward-Clyde Consultants

WCC26 Phase III; Vol. III A

Monoliths M2/6 , Prototype Pile No. 11   Pile Type MP102
Final Pile Penetration 47 ft

Monoliths M2/6 , Prototype Pile No. 12 , Pile Type MP102
Final Pile Penetration 53.75 ft

Sequence No.		1101			[illegible]			1201			[illegible]			1102			[illegible]			1202			[illegible]					
Pile Penetration ft		2			22			6'			21			22			47			21			53'9"					
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	M1		V			V			V			V			V			V			V							
[illegible]	G2-11		V	X		V	X		V	X		V	X		V	X		V	X		V	X						
[illegible]	M2																											
[illegible]	G2-15																											
[illegible]	M3																											
[illegible]	G12-52																											
[illegible]	F3			X			X			X			X			X			X			X						
[illegible]	G5-50		X			X			X			X			X			X			X							
[illegible]	F5			X			X			X			X			X			X			X						
10	G5-15		X			X			X			X			X			X			X							
11	G3-15																											
[illegible]	G5-1		X			X			X			X			X			X			X							
[illegible]	G11-1		X			X			X			X			X			X			X							
[illegible]	G4-1			X			X			X			X			X			X			X						
[illegible]	G11-15																											
[illegible]	G4-15																											
[illegible]	G11-50																											
[illegible]	G4-50																											

Note : Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component

SA or PVM : Peak Vibration Monitor
Osc. : Oscillograph
Tape : Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITHS M2/6 PROTOTYPE PILES No. 11 and 12

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-70-C-0005

Woodward-Clyde Consultants

WCC Phase III ; Vol. III A

Monoliths M2/6 , Prototype Pile No. 13 Pile Type HP 14x73
Final Pile Penetration 51 ft

Sequence No.		1301.			1302											
Pile Penetration ft		3'2"			25'			51								
Junction Box Channel	Geophone No.															
1	M1		V			V										
2	612-1		V	X		V	X									
3	M2															
4	612-15															
5	M3															
6	612-50															
7	F3			X			X									
8	65-5		X			X										
9	F5			X			X									
10	65-15		X			X										
11	63-15															
12	65-1		X			X										
13	611-1		X			X										
14	64-1			X			X									
15	611-15															
16	64-15															
17	611-50															
18	64-50															

Monoliths M2/6 , Prototype Pile No. 14 , Pile Type PP 14x0.375
Final Pile Penetration 51 ft

Sequence No.		1401.			1402			1403			1404					
Pile Penetration ft		4'4"			15			30			45			51		
Junction Box Channel	Geophone No.															
1	M1		V			V			V			V				
2	612-1		V	X		V	X		V	X		V	X			
3	M2															
4	612-15															
5	M3															
6	312-50															
7	F3			X			X			X			X			
8	65-50		X			X			X			X				
9	F5			X			X			X			X			
10	65-15		X			X			X			X				
11	63-15															
12	65-1		X			X			X			X				
13	611-1		X			X			X			X				
14	64-1			X			X			X			X			
15	611-15															
16	64-15															
17	611-50															
18	64-50															

Note : Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component
SA or PVM : Peak Vibration Monitor
Osc. : Oscillograph
Tape : Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITHS M2/6 PROTOTYPE PILES No. 13 and 14

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-70-C-0008

Woodward-Clyde Consultants

WCC Phase II VOL II A

Y7C-825
Phase IV ; Vol III A

M.8 INFORMATION DIGITIZED FROM ANALOG MAGNETIC TAPE FOR MONOLITH M2

Geophone No.	Prototype Pile No and Depth of Digitization (ft)													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
G5-1	30 60 104	20, 35, 50, 70, 94	35, 50, 70	35 50 70	35 50 70	35, 50, 70, 94	35, 70, 94	50 70 94	25, 35, 70, 94	20, 35, 50, 70, 94	25, 45	25 50	20 35 50	20 35 50
G5-15	30 60 104	35, 50, 70, 94	35, 50, 70	35 50 70	35 50 70	35 50	70 94	50 70 94	34, 70, 94	20, 35, 50, 70, 94	25 45	25 60	20 35 50	20 35 50
G5-50	30 60 104	35, 50, 70, 94	35, 50, 70			35 50	70 94	50 70 94	35, 70, 94	20, 35, 50, 70, 94	25 45	25 50	20 35 50	20 35 50
G1-1		20, 35, 50, 70, 94				35 50		50 70 94	35, 70, 94	20, 35, 50, 70, 94	25 46	25 50	20 35 50	20 35 50
MG1						35*, 50* 70 94	35	50* 70* 94*	25	20*, 35*, 50*, 70*, 94*	25* 45*	25* 50*	20* 35* 50*	20* 35* 50*
MG2						70 94	35		25					
MG3						70 94	35		25					

Note: * z Component only

Depth of Digitization is the prototype pile tip depth at which the digitized data recorded during the tests on analog magnetic tape, were processed through a computer.

PILE DRIVING EFFECTS TEST PROGRAM
INFORMATION DIGITIZED FROM ANALOG MAGNETIC TAPE FOR MONOLITHS M2 & M6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-[illegible]

Woodward-Clyde Consultants
[illegible] Phase II; VOL III A

PHASE IV REPORT

VOLUME IIIA

RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM

APPENDIX N

MEASUREMENT DETAILS MONOLITH M3

TABLE OF CONTENTS

N MEASUREMENT DETAILS, MONOLITH M3

N.1 COMPLETE FIELD LOGS OF INSTALLATION OF TIMBER PILES UNDER MONOLITH M3

The identification number (Id. No.) at the top right-hand corner of each data sheet includes the timber pile number shown in Fig. 3.2, Volume III.

The timber pile number is given by the two digits preceeding the last two zeros of the Id. No. (for example, page N-2 corresponds to timber pile No. 03).

The field logs are presented in chronological order of timber pile installation.

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

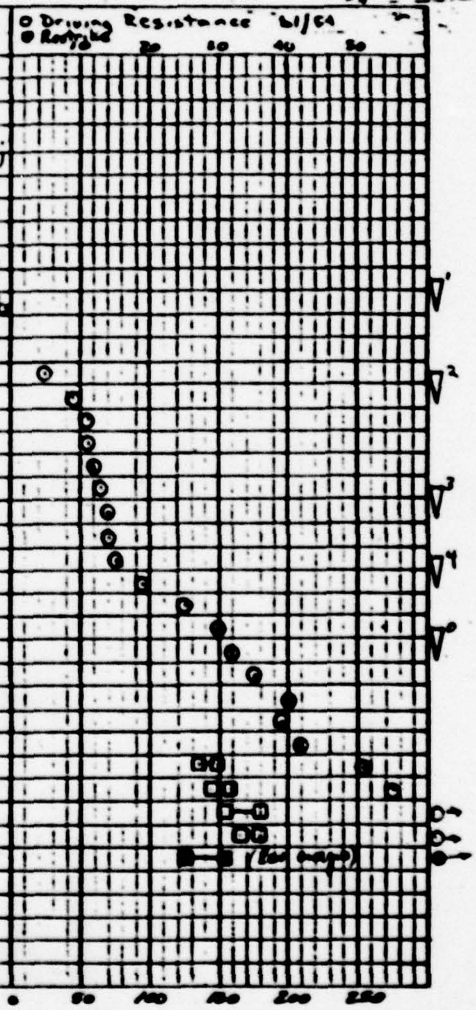
P. 1 of 1

PILE DRIVING RECORD

ID No. 03 03 160 1 0300

Pile Type Douglas Fir (2) Hammer Vulcan V-1 Date 22 Oct 78
Pile length 42' Energy 15,000 Time 1730 → 1830
Ground el. Trench Level Operating Rate 60 bl/min Inspector - Koch/Greene

Depth ft	Blows	Remarks
		1730
0-1		During pre-jetting,
2		jet stops at 20', 31',
3		20', 21', 26', 35';
4		lignite in return wash;
5		
6		Pile sinks 15' 6" off-center; remove pile;
7		center; remove pile;
8		pile sinks 4' with jet
9		on S side; pile sinks
10		to 11' with jet; jet to
11		15', 20', 23'; pile sinks
12		to 19'
13		
14	5	
15	9	
16	11	
17	11	
18	12	
19	13	
20	14	
21	14	
22	15	
23	19	
24	25	
25	30	
26	32	
27	35	
28	40	
29	39	
30	42	
31	51	
32	55	
33	68	
34	84	19:30
35	110/6"	restrike 10/25/78



Dynamic measurements yes
Sequence No — Depth ft
01 (PDA) — 30'-34'
02 restrike (PDA) — 34'-34'6"

Notes:
Pile batter at EOD
1.2% N
4.5% E

□ Capacity, kips
■ Restrike
▽ Jetting depth

✓ H.C.L.
10 Oct '78

WCC, 77C823, Phase II
Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

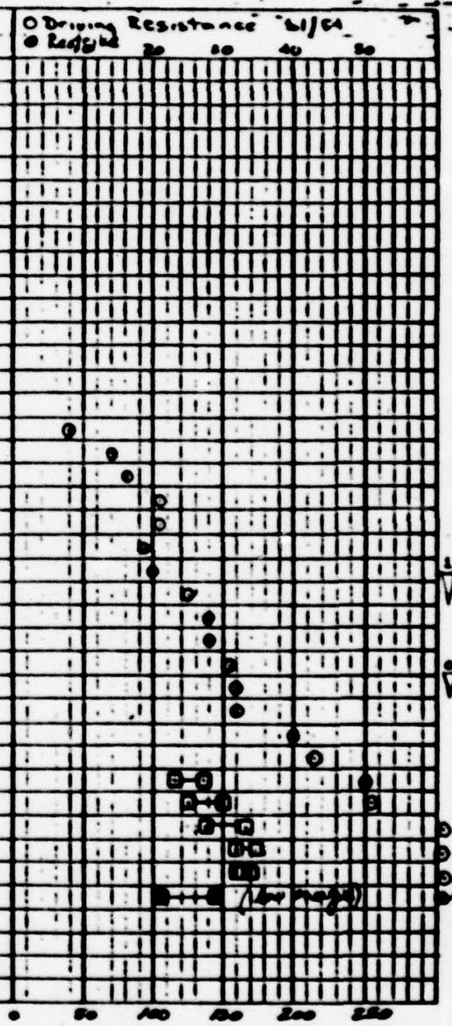
P. 1 of 1

PILE DRIVING RECORD

ID No. 03 03 T60 I 2800

Pile Type	Douglas Fir	Hammer	Vulcan V1	Date	22 Oct 1978
Pile length	41'	Energy	15000	Time	19:30
Ground el.	Trench level	Operating Rate	60 blows/min	Inspector	Rob Gillis

Depth ft	Blows	Remarks
0-1		
2		
3		Pre-jetted to 27'
4		Pile ran to 15'
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16	8	
17	16	
18	16	
19	21	
20	21	
21	19	
22	20	
23	25	
24	29	
25	28	
26	31	
27	32	
28	32	
29	40	
30	43	Jet, jet tip to 33'
31	50	
32	52	
33	73	
34	78	
35	33 for 5"	
	157/10"	restrike 10/23/78



Dynamic Measurements

Sequence No	Depth ft
01 (PDA)	30'-34'
02 restrike (PDA)	35'5"-35'11"

Notes:
Pile batter at EOD
1.2% S
2.2% W

□ Capacity, kips
● Restrike
▽ Jetting depth

WCC, VTC EIS, Phase II
Vol IIIA

J.H.L.
10 Oct 78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

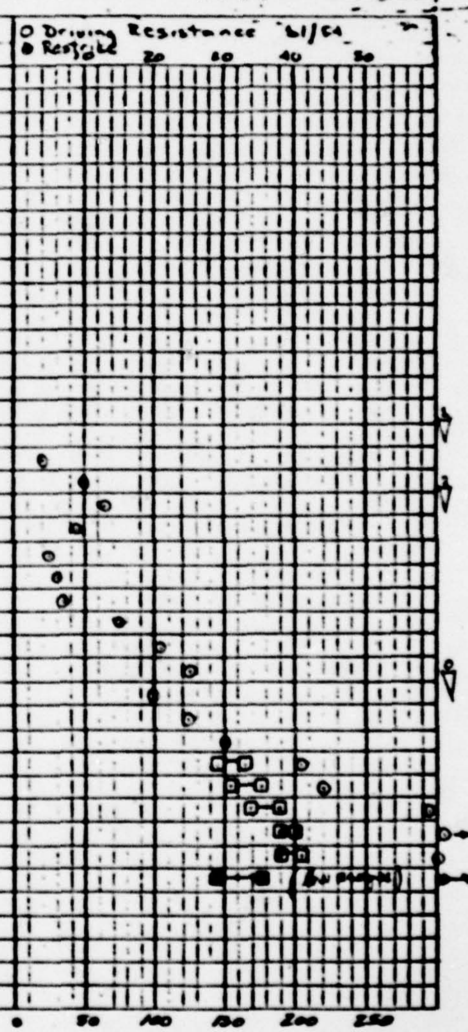
PILE DRIVING RECORD

P. 1 of 1

ID No. 05 03 T60 1 1600

Pile Type Douglas Fir — Hammer Vulcan V1 — Date 22 Oct 1978
Pile length 62' — Energy 15000 ft lbs — Time 20:40
Ground el. Trench level — Operating Rate 60 blows/min — Inspector - Bob Green

Depth Ft	Blows	Remarks
0-1		21:48
2		
3		
4		Pre-jetted to 27'
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15	↓	
16	↓	Jet, jet on S.E. side of pile
17	4	
18	10	
19	13	Jet, jet on S.E. side of pile
20	9	
21	5	
22	6	
23	7	
24	15	
25	21	
26	25	
27	20	
28	25	
29	30	22:20
30	41	
31	44	
32	59	
33	64	
34	20 for 4"	22:33
35	88/6"	restrike 10/25/78



Dynamic measurements 9/8
Sequence No. — Depth Ft.
01 (PDA) — 29'-33'4"
02 restrike (PDA) — 33'4"-34'10"

Notes:
Pile batter at E.O.D.
0.9% S
3.0% E

□ Capacity, Kips
■ Restrike
▽ Jetting depth

WCC, VTC B2S, Phase II
Vol II A

✓ M.C.L.
10ct'78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 20
PILE DRIVING EFFECTS TEST

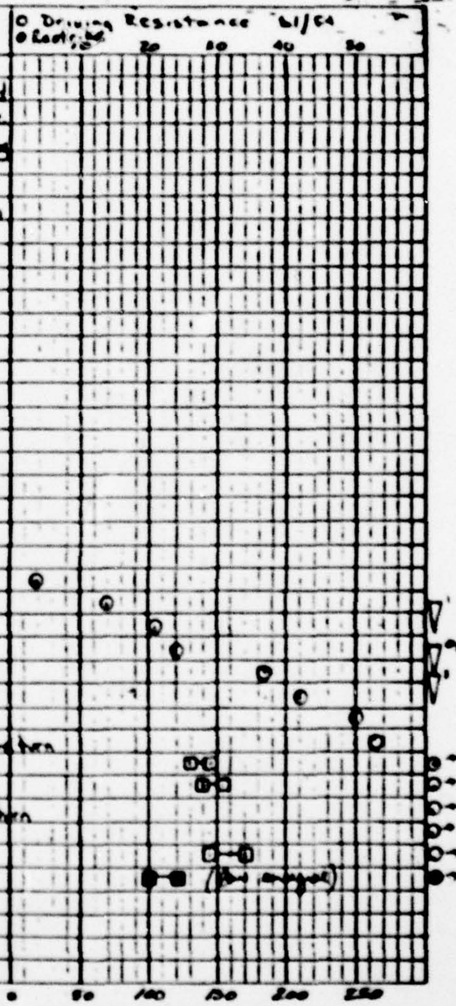
PILE DRIVING RECORD

P. 1 of 1

ID No. 08 03 160 1 1500

Pile Type Douglas Fir (I) Hammer Vulcan V-1 Date 22-23 Oct 78
Pile length 42' Energy 15,000 Time 2300 → 0035
Ground el. Trench Level Operating Rate 60 bl/min Inspector - Kuch/Bosch

Depth ft	Blows	Remarks
		23:00
0-1	↓	During prejetting, jet
2		drops to 21', 24', 27'; good
3		returns at 27' with liquid
4		and clay; jet pump running
5		at 1500 RPM
6		
7		Pile sinks 22'; location
8		slightly to N
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22	↓	
23	4	
24	19	
25	21	
26	24	
27	37	
28	42	
29	50	
30	53	23:35 Jet to 25', good return
31	68	
32	77	Jet to 27' 23:57
33	70	00:20, Jet to 28' good return
34	97	clay and liquid at return
35	25/5"	pass
	148/6"	restrike 10/25/78



Dynamic measurements yes

Sequence No.	Depth ft
01 (PDA)	30'-31' 34'-35'
02 restrike (PDA)	35' - 35'6"

Notes:
Pile batter at E.O.D.
1.6% N
1.9% E

WCC, VTC 815, Phase V
Vol II A

10 Oct '78

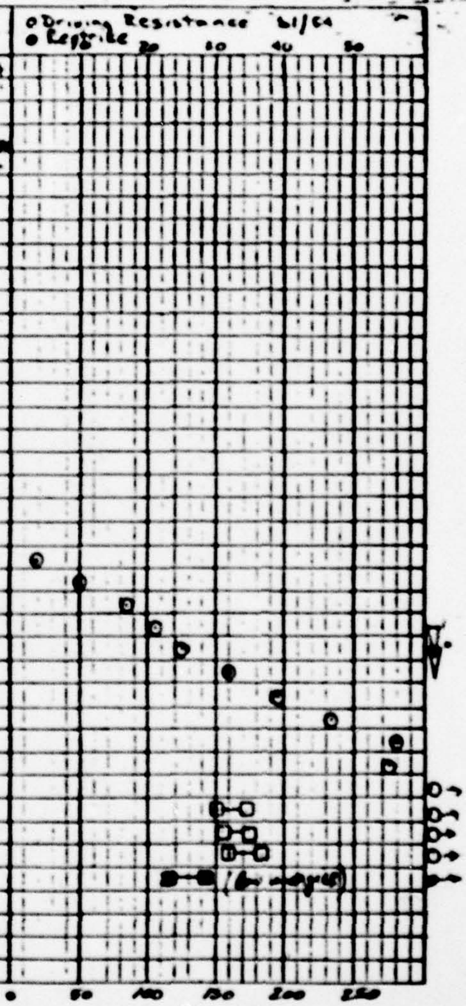
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 03 160 1 P 24 60 1 of 1

Pile Type Douglas Fir(I) Hammer Vulcan V-1 Date 23 Oct 78
Pile length 42' Energy 15,000 Time 0045 → 0157
Ground el. Trench level Operating Rate 60 bl/min Inspector - Kisch/Grady

Depth ft	Blows	Remarks
0-1		00:45, During prejetting jet
2		drops to 24', 23', 20', at
3		31', 27' slowly; wash
4		at 27' with good return
5		Clay and lignite in water
6		returns
7		
8		Pile sinks 21'
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21	↓	
22	4	
23	10	
24	18	
25	21	
26	25	
27	32	
28	39	
29	47	
30	56	01:35 Jet to 26'
31	55	
32	69	01:45
33	77	
34	62	
35	36/7'	01:57
	92/6"	restrike 10/25/78



Dynamic measurements yes
Sequence No Depth ft
01 (PDA) 33'-35'
02 restrike (PDA) 35'-35'6"

□ Capacity, kips
● Restrike
▽ Jetting depth

Notes:
Pile batter at E.O.D.
0.7 % S
3.5 % E

WCC, 77C 815, Phase V
Vol III A

J.H.C.
10 Oct '78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

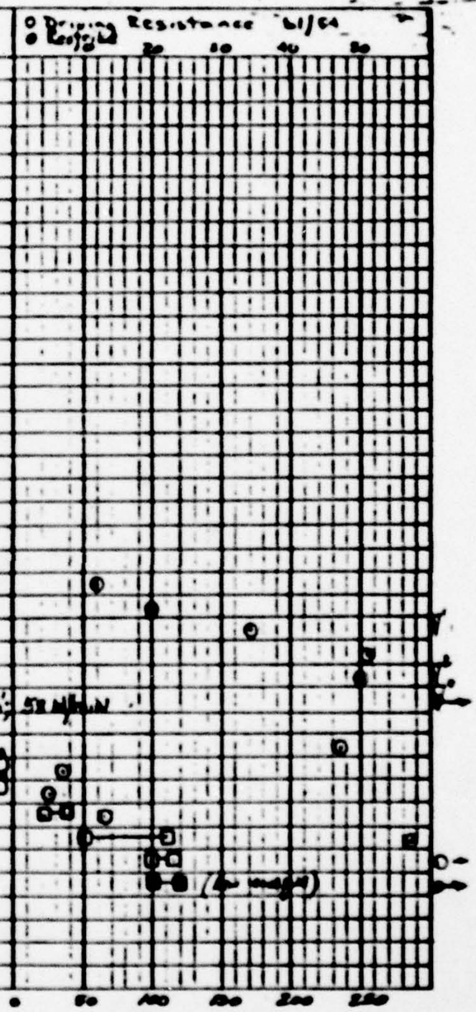
PILE DRIVING RECORD

P. 1 of 1

ID No. 03 03 160 1 0600

Pile Type	Douglas Fir	Hammer	Vulcan #1	Date	23 Oct 78
Pile length	42.1'	Energy	15,000	Time	0710 → 0852
Ground el.	Trench Level	Operating Rate	60 bl/min	Inspector	Locke/Tso

Depth ft	Blows	Remarks
0-1	↓	07:10
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		Lignite returned at 12'
13		
14		
15		
16		
17		Pile sinks 19½"
18		
19		
20	↓	
21		
22		
23	12	
24	20	
25	34	
26	61	
27	50	
28	65	Lignite wood returned at 28'; 58 bl/min
29		?8 data taken
30	47	Jet to 25' while driving
31	7	Jet to 27' while driving
32	6	
33	13	
34	59	retract jet
35	66	08:52
	70/6"	restrike 10/25/78



Dynamic Measurements

Sequence No	Depth ft
01 (PDA)	28'-35'
02 restrike (PDA)	35'-35'6"

Notes:
Pile batter at E.O.D.
0.8% N
3.4% E

□ Capacity, kips
● Restrike
▽ Jetting depth

WCC, VTC 815, Phase II
Vol III A

JLC S.L.
10Oct 78

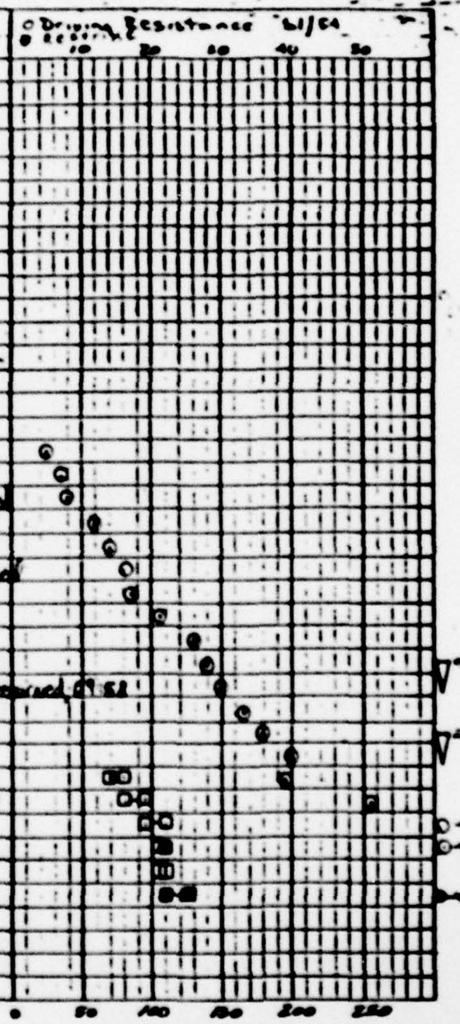
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

P. 1 of 1

ID No. 08 03 160 1 1300

Pile Type	Douglas fir	Hammer	Vulcan V-1	Date	23 Oct 78
Pile length	41.7'	Energy	15,000	Time	0910 → 1043
Ground el.	trench level	Operating Rate	60 bl/min	Inspector	Locke/[illegible]

Depth ft	Blows	Remarks
0-1	↓	09:10
2		
3		Prejetted to 27'
4		
5		Pile sinks 15'6"
6		
7		
8		
9		
10		At 10' wood returned
11		
12		At 12', much lignite
13		returned with diameter
14		of approx 1.5"
15		
16		
17	5	
18	7	
19	8	At 19', much lignite returned
20	12	At 20', lose circulation
21	17	
22	16	At 22', clay balls returned
23	17	
24	21	
25	26	
26	28	53 bl/min
27	30	Jet to 27', clay balls, lignite returned 09:58
28	33	62 bl/min
29	36	
30	40	54 bl/min
31	39	Jet to 30' while driving
32	51	
33	75	
34	76	
35	?	10:43
	57/6"	restrike 10/25/78



Dynamic Measurements

Sequence No.	Depth ft
01 (SDA)	20-35'
02 restrike (SDA)	35'-35'6"

Notes:
Pile batter at E.O.D.
0.8% N
1.3% E

□ Capacity, kips
● Restrike
▽ Jetting depth

✓ H.C.L.
10 Jul '80

WCC, 77C 815, Phase II
VOL III A

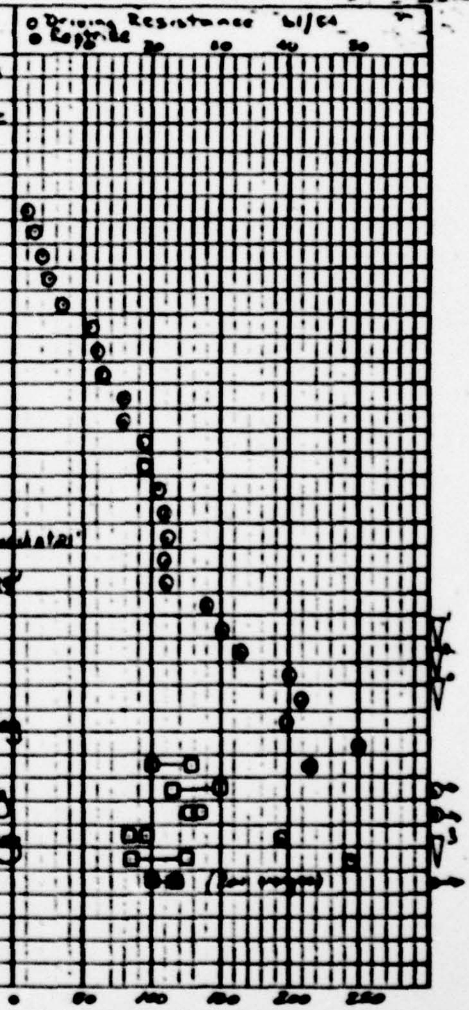
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 03 160 1 1900 — P. 1 of 1

Pile Type: Douglas fir — Hammer: Vulcan V-1 — Date: 23 Oct 78
Pile length: 42' — Energy: 15,000 — Time: 1050 → 1342
Ground el.: trench level — Operating rate: 60 bl/min — Inspector: Locke/[illegible]

Depth ft	Blows	Remarks
0-1	↓	1050 Pile sinks 1½'; pile is
2	↓	3" to 5; pile removed
3	↓	and repositioned; pile
4	↓	sinks 3'
5	↓	
6	1	
7	2	
8	3	
9	4	
10	5	
11	7	
12	11	
13	12	lignite at 13' to 17'
14	13	
15	16	
16	16	
17	19	Clay balls in wash at 19'
18	19	
19	21	53 bl/min
20	22	lose circulation at 20'
21	22	lignite, small clay fragments in wash at 21'
22	22	Wood in wash at 22'
23	28	Lignite in wash at 23' to 25'
24	28	
25	30	
26	33	57 bl/min
27	40	
28	42	
29	40	Jet to 25.5' while driving
30	50	
31	49	
32	86	Jet to 27' while driving
33	83	
34	99	Jet to 35' while driving
35	30/25	13:42
	58/6"	restrike 10/25/78



Dynamic Measurements

Sequence No	Depth ft
01 (PDA)	20'-34'10"
02 restrike (PDA)	34'10"-35'10"

Notes:
Pile Dia. at EOD
25% S
0.1% W

WCC, VTC B25, Phase II, Vol III A

✓ M.C.S.
10 Oct 79

N.2 SUMMARY LOG OF DATA ACQUIRED DURING PRELOADING, MONOLITH M3

ID No.: 07-03&07-

MONOLITH(S) TESTED: M3 & M7

TEST TYPE: PRELOADING

	Sequence No.	0000	0000	0007	0011	0023
	Date/Time	12/18/78	12/19 0135	12/19 0549	12/19 0707	12/19 1045
	Description of Event	INITIALIZATION	INITIALIZATION	FULL AXIAL V = 240t M3 V = 30t M7	FULL AXIAL V = 240t M3 V = 30t M7	FULL AXIAL H = FULL
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓		✓
PRIMARY DATA	Optical Horizontal Control, P(1)	✓	partial	partial	ref beams only	partial
PRIMARY DATA	Optical Vertical Control, P(1)	✓		ref beams only		ref beams only
PRIMARY DATA	Tape Extensometer, P(1)	✓				ref beams only
PRIMARY DATA	Tilt Meters, P(1)		✓	✓		✓
PRIMARY DATA						
PRIMARY DATA						
PRIMARY DATA						
SECONDARY DATA	Timber Pile Inclinometers, S(9)					No. 13 & 19 only
SECONDARY DATA	Timber Pile Slopes, S(9)					
SECONDARY DATA	Tell Tales, S(10)	✓	✓	✓		
SECONDARY DATA	Surface Settlement, S(11)	✓				
SECONDARY DATA	Ground Inclinometers, S(12)					
SECONDARY DATA	Sondex, S(12)					
SECONDARY DATA	Piezometers, S(13)	✓				✓
SECONDARY DATA	Thermo-couples, S(14)	✓		✓		✓
SECONDARY DATA	Strain Gages, S(10)		✓	✓		✓
SECONDARY DATA						
SECONDARY DATA	Record No. – 02		BALANCE	5 [illegible]		4 [illegible]
SECONDARY DATA	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C 825
Phase IV, Vol III A

ID No.: 07-03807-

MONOLITH(S) TESTED: M3 & M7

TEST TYPE: PRELOADING

	Sequence No.	0042	0048	0070	0080	0092
	Date/Time	12/19 1523	12/19 1738	12/19 2158	12/19 2306	12/20 0438
	Description of Event	FULL AXIAL H = FULL N = 10	FULL AXIAL H = FULL N = 10	FULL AXIAL H = FULL N = 20	FULL AXIAL H = FULL N = 25	FULL AXIAL H = FULL N = 30
PRIMARY DATA	Dial Gages, P(1)	✓		✓	✓	
	Optical Horizontal Control, P(1)	✓	partial		✓	partial
	Optical Vertical Control, P(1)	✓			✓	
	Tape Extensometer, P(1)	✓			ref bases only	
	Tilt Meters, P(1)	✓			✓	
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)					
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)	✓			✓	
	Sondex, S(12)					
	Piezometers, S(13)	✓			✓	
	Thermo-couples, S(14)	✓			✓	
	Strain Gages, S(10)					
	Record No. – 02					
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C855
Phase II, Vol III A

ID No.: 07-03&07-

MONOLITH(S) TESTED: M3 & M7

TEST TYPE: PRELOADING

	Sequence No.	0095	0115	0131	0134	
	Date/Time	12/20 0537	12/20 0939	12/20 1301	12/20 1520	
	Description of Event	FULL AXIAL H = 1/10 FULL N = 30	FULL AXIAL H = FULL N = 40	FULL AXIAL H = FULL N = 47	V = 0 H = 0	
PRIMARY DATA	Dial Gages, P(1)		✓	✓	✓	
PRIMARY DATA	Optical Horizontal Control, P(1)	partial	ref beams only	✓	ref beams only	
PRIMARY DATA	Optical Vertical Control, P(1)		—	✓	ref beams only	
PRIMARY DATA	Tape Extensometer, P(1)			ref beams only	ref beams only	
PRIMARY DATA	Tilt Meters, P(1)			✓		
PRIMARY DATA						
PRIMARY DATA						
PRIMARY DATA						
SECONDARY DATA	Timber Pile Inclinometers, S(9)			No. 13 & 19 only		
SECONDARY DATA	Timber Pile Slopes, S(9)					
SECONDARY DATA	Tell Tales, S(10)					
SECONDARY DATA	Surface Settlement, S(11)					
SECONDARY DATA	Ground Inclinometers, S(12)			✓		
SECONDARY DATA	Sondex, S(12)			✓ except PD-3DB		
SECONDARY DATA	Piezometers, S(13)			✓		
SECONDARY DATA	Thermo-couples, S(14)			✓		
SECONDARY DATA	Strain Gages, S(10)				✓	
SECONDARY DATA						
SECONDARY DATA	Record No. – 02				4	
SECONDARY DATA	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C 825
Phase II, Vol III A

N.3 SUMMARY LOG OF DATA ACQUIRED DURING
PILE DRIVING, MONOLITH M3

ID No.: 09-03607-

MONOLITH(S) TESTED: M3 & M7

TEST TYPE: PDET

	Sequence No.	0000	0006	0102	0105	0202
	Date/Time	3/1/79 1200	3/2 0800	3/2 1430	3/2 1800	3/3 0000
	Description of Event	INITIALIZATION (NO LOAD)	FULL AXIAL AND LATERAL LOAD APPLICATION	PILE NO. 1 ~50 ft HALF PENETRATION	PILE NO. 1 ~100 ft FULL PENETRATION	PILE NO. 2 ~52 ft HALF PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓	✓	✓	✓
	Tilt Meters, P(1)	✓		✓	✓	✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓ except No. 2B			✓ except No. 2B	
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	✓
	Surface Settlement, S(11)	✓		✓	✓	
	Ground Inclinometers, S(12)	✓			partial	
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	✓
	Strain Gages, S(10)	✓	✓		✓	✓
	Record No. – 02	BALANCE	10, 11		12	14, 15
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C825
Phase IX, Vol III f

ID No.: 09-03&07-

MONOLITH(S) TESTED: M3 & M7

TEST TYPE: PDET

	Sequence No.	0203	0300	0302	0305	0402
	Date/Time	3/3 0230	3/3 0800	3/3 1400	3/3 1800	3/3 2320
	Description of Event	PILE NO. 2 ~96ft FULL PENETRATION	PILE NO. 3 START	PILE NO. 3 ~52ft HALF PENETRATION	PILE NO. 3 ~96ft FULL PENETRATION	PILE NO. 4 ~52ft HALF PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓	✓	✓	✓
	Tilt Meters, P(1)	✓	✓	✓	✓	✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	✓
	Surface Settlement, S(11)		✓	✓		partial
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	✓
	Strain Gages, S(10)	✓	✓	✓	✓	✓
	Record No. – 02	15	16	17	18	19
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C825
Phase IV; Vol III A

ID No.: 09-03&07-

MONOLITH(S) TESTED: M3 & M7

TEST TYPE: PDET

	Sequence No.	0403	0405	0502	0504	0504
	Date/Time	3/6 0800	3/5 1630	3/5 2200	3/6 0030	3/6 0800
	Description of Event	PILE NO. 4 ~52ft HALF PENETRATION	PILE NO. 4 ~96ft FULL PENETRATION	PILE NO. 5 ~53ft HALF PENETRATION	PILE NO. 5 ~96ft FULL PENETRATION	PILE NO. 5 ~96ft FULL PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓		✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓	✓	✓	✓
	Tilt Meters, P(1)	✓	✓	✓	✓	✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	✓
	Surface Settlement, S(11)	✓	✓	✓	✓	
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	
	Strain Gages, S(10)	✓	✓	✓	✓	✓
	Record No. – 02	20	22	23	24	25
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C825
Phase IV, Vol III A

ID No.: 09-03607-

MONOLITH(S) TESTED: M3 & M7

TEST TYPE: PDET

	Sequence No.	0504	0604	0606	0703	0800
	Date/Time	3/6 1200	3/6 1600	3/6 2100	3/7 0030	3/7 0800
	Description of Event	PILE NO. 5 ~ 96ft FULL PENETRATION	PILE NO. 6 ~52ft HALF PENETRATION	PILE NO. 6 ~96ft FULL PENETRATION (10)'	PILE NO. 7 ~50ft FULL PENETRATION	PILE NO. 8 START
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)		✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓	✓	✓	✓
	Tilt Meters, P(1)	✓	✓	✓	✓	✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)		✓	✓	✓	✓
	Surface Settlement, S(11)			✓	✓	
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)		✓	✓	✓	✓
	Strain Gages, S(10)	✓	✓	✓	✓	
	Record No. – 02	26	27	28	29	
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C88 5
Phase IV Vol III A

ID No.: 09-03&07-

MONOLITH(S) TESTED: M3 & M7

TEST TYPE: PDET

	Sequence No.	0802				
	Date/Time	3/7 1200				
	Description of Event	PILE NO. 8 ~51ft FULL PENETRATION				
PRIMARY DATA	Dial Gages, P(1)	✓				
	Optical Horizontal Control, P(1)	✓				
	Optical Vertical Control, P(1)	✓				
	Tape Extensometer, P(1)	✓				
	Tilt Meters, P(1)	✓				
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓ except No 28				
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓				
	Surface Settlement, S(11)	✓				
	Ground Inclinometers, S(12)	✓				
	Sondex, S(12)					
	Piezometers, S(13)	✓				
	Thermo-couples, S(14)	✓				
	Strain Gages, S(10)	✓				
	Record No. – 02	31,32				
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C825
Phase IV, [illegible]

N.3 SUMMARY LOG OF DATA ACQUIRED DURING

LATERAL LOAD TESTING, MONOLITH M3

ID No.: 10-03

MONOLITH(S) TESTED: M3

TEST TYPE: LOAD TEST

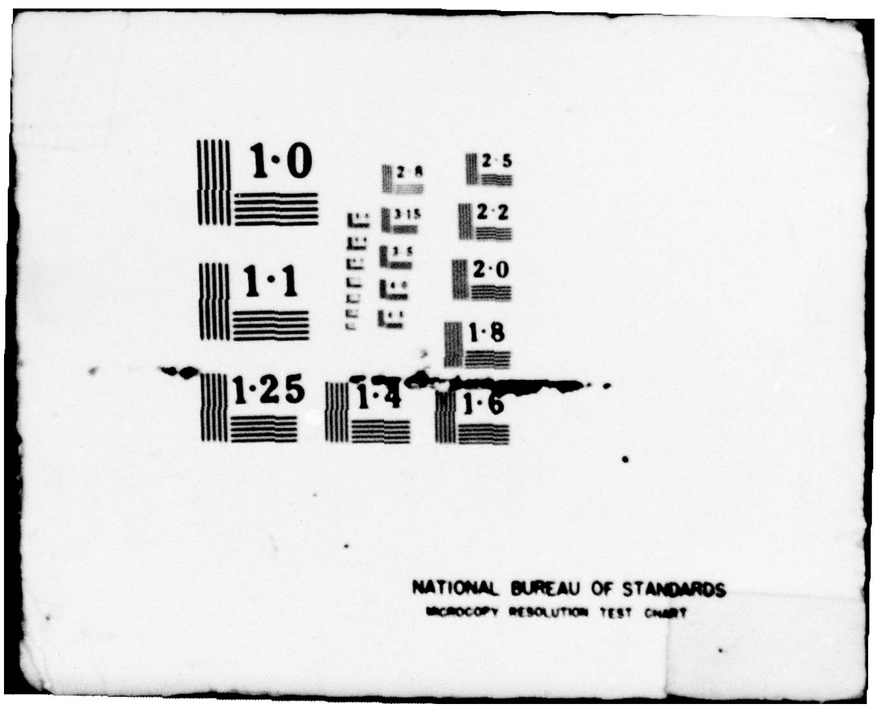
	Sequence No.	0000	0001	0002	0003	0004
	Date/Time	3/8/79 0000	3/8 0900	3/8 1420	3/8 1800	3/9 0100
	Description of Event	INITIALIZATION M3	V = 240t H = 0	V = 400t H = 0	V = 240t H = 0	V = 240t H = 48t
PRIMARY DATA	Dial Gages, P(1)	✓		✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓		✓	✓	✓
	Tilt Meters, P(1)	✓		✓	✓	✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)					✓ except No. 28
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓		✓	✓	✓
	Surface Settlement, S(11)	✓				
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓		✓	✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	✓
	Strain Gages, S(10)	✓	✓	✓	✓	✓
	Record No. – 02	BALANCE	5	6	7	8
	Record No. – 03					

Note: ✓ = Complete set of readings taken

AD-A076 094 WOODWARD-CLYDE CONSULTANTS CHICAGO IL F/G 13/2
RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM--ETC(U)
JUL 79 J PEREZ , D M HOLLOWAY DACW43-78-C-0005

UNCLASSIFIED NL

5 OF 6
AD-
A076094


1·0
1·1
1·25
1·4
1·6
1·8
2·0
2·2
2·5
NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

XTC 885
Part [illegible], Vol III A

ID No.: 10 - 03

MONOLITH(S) TESTED: M3

TEST TYPE: LOAD TEST

	Sequence No.	0004	0006	0007	0008
	Date/Time	3/9 0400	3/9 0800	3/9 1600	3/9 2230
	Description of Event	V = 240t H = 48t	V = 240t H = 48t	V = 240t H = 96t	V = 240t H = 96t
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓
PRIMARY DATA	Optical Horizontal Control, P(1)	✓	✓	✓	✓
PRIMARY DATA	Optical Vertical Control, P(1)	✓		✓	✓
PRIMARY DATA	Tape Extensometer, P(1)	✓		✓	✓
PRIMARY DATA	Tilt Meters, P(1)			✓	
PRIMARY DATA					
PRIMARY DATA					
PRIMARY DATA					
SECONDARY DATA	Timber Pile Inclinometers, S(9)			✓ except No. [illegible]	
SECONDARY DATA	Timber Pile Slopes, S(9)				
SECONDARY DATA	Tell Tales, S(10)			✓	✓
SECONDARY DATA	Surface Settlement, S(11)				
SECONDARY DATA	Ground Inclinometers, S(12)			✓	
SECONDARY DATA	Sondex, S(12)				
SECONDARY DATA	Piezometers, S(13)			✓	✓
SECONDARY DATA	Thermo-couples, S(14)			✓	✓
SECONDARY DATA	Strain Gages, S(10)	✓	✓		✓
SECONDARY DATA					
SECONDARY DATA	Record No. – 02	9	10, 11		13
SECONDARY DATA	Record No. – 03				

Note: ✓ = Complete set of readings taken

Y7C-825
Phase IV; Vol III A

N.5 COMPLETE DRIVING RECORDS OF PROTOTYPE PILES DRIVEN WITH IMPACT HAMMER, MONOLITH M3

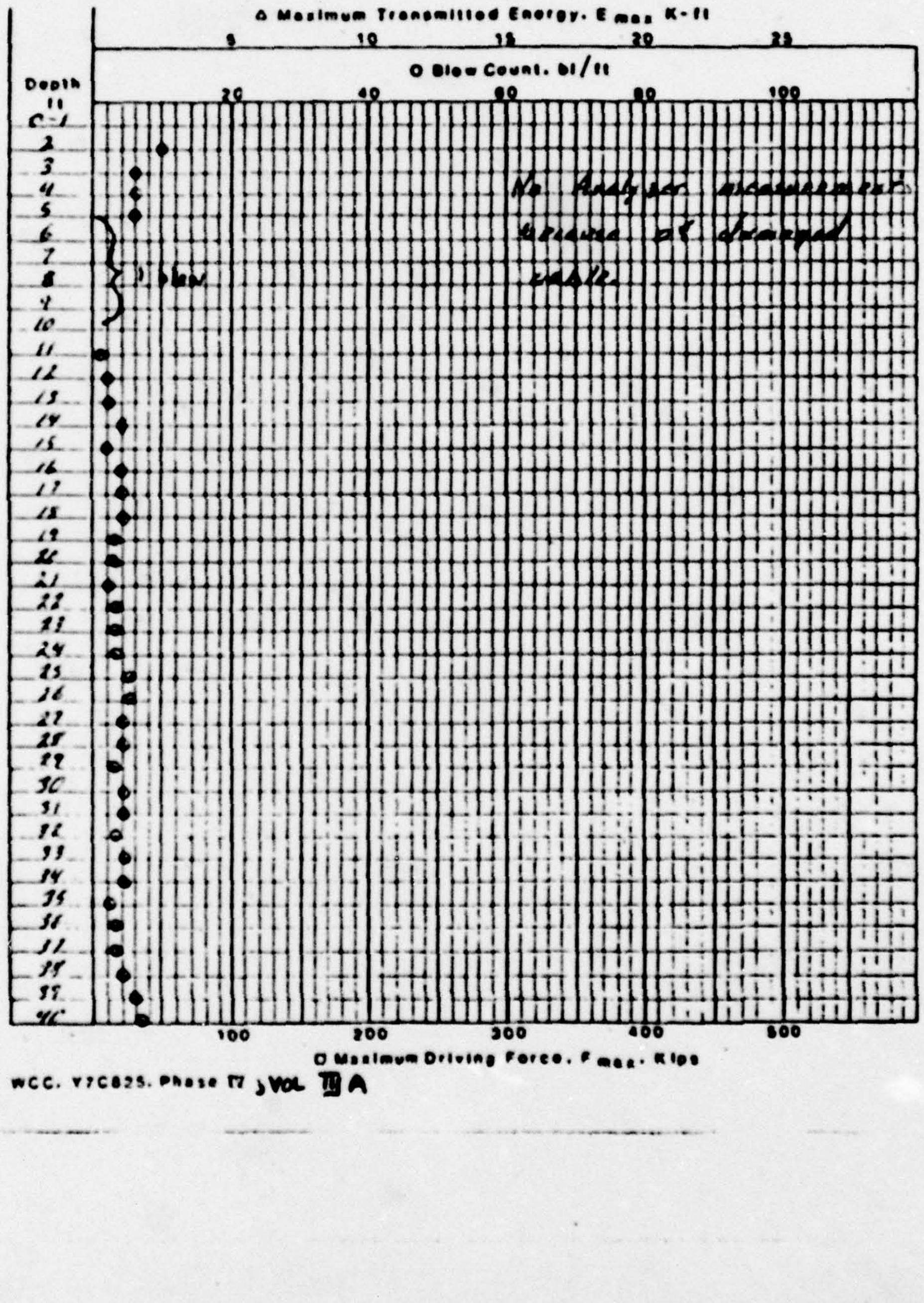
The driving records are presented in chronological order of driving for prototype piles No. 1 through 8, driven with a VULCAN 010 hammer.

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 3
I.D. No. 09 03 190 0 0190
Date 3/2/79
Operator AZ

PILE DRIVING MEASUREMENTS
PILE NO. 01

	Time	Sequence No.
First		
Finish		



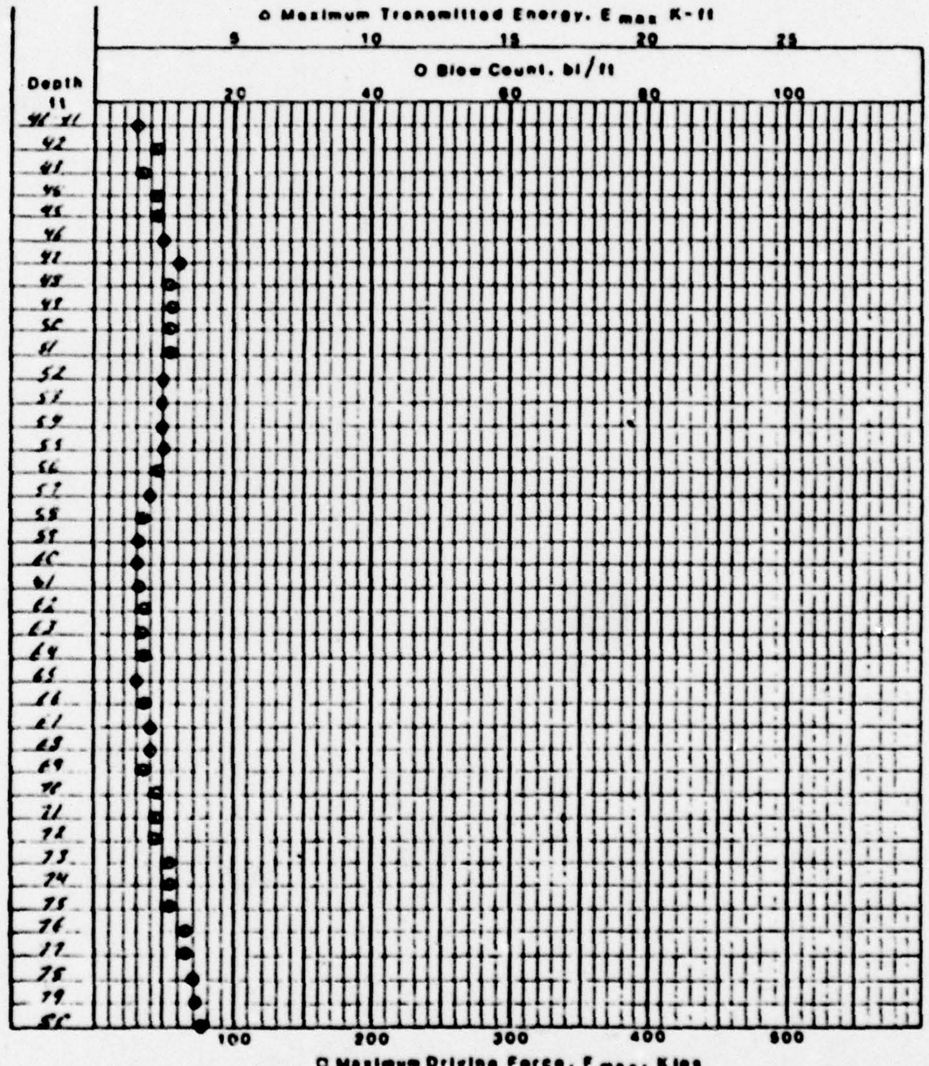
WCC. Y7C625. Phase IV, VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 3
I.D. No. 09 03 180 0 0100
Date 3/2/79
Operator RZ

PILE DRIVING MEASUREMENTS
PILE NO. 01

	Time	Sequence No.
First		
Finish		



WCC. Y7C825. Phase II ; VOL II A

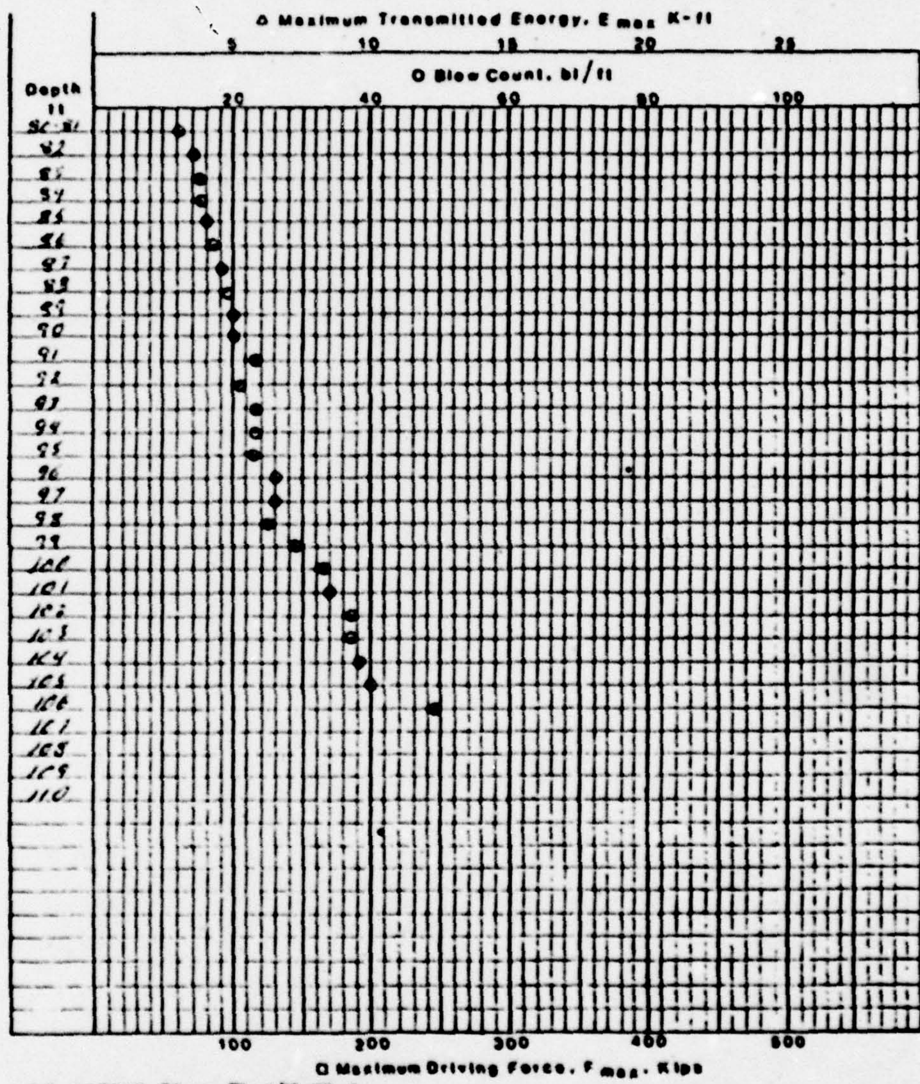
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 3 of 3
I.D. No. 09 03 180 0 pile
Date 3/2/79
Operator AZ

PILE DRIVING MEASUREMENTS

PILE NO. 01

	Time	Sequence No.
First		
Finish		

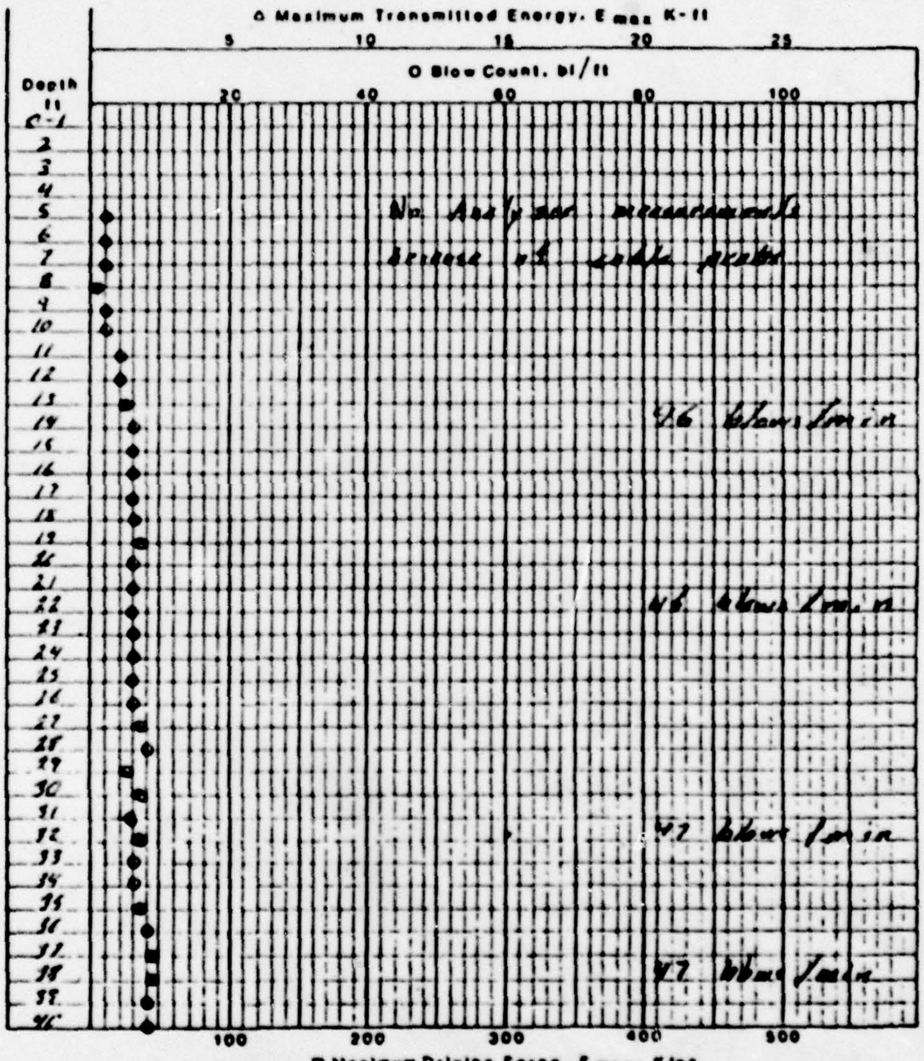


WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 3
I.D. No. 09 03 180 1
Date
Operator

PILE DRIVING MEASUREMENTS
PILE NO. 02

	Time	Sequence No.
First		
Finish		



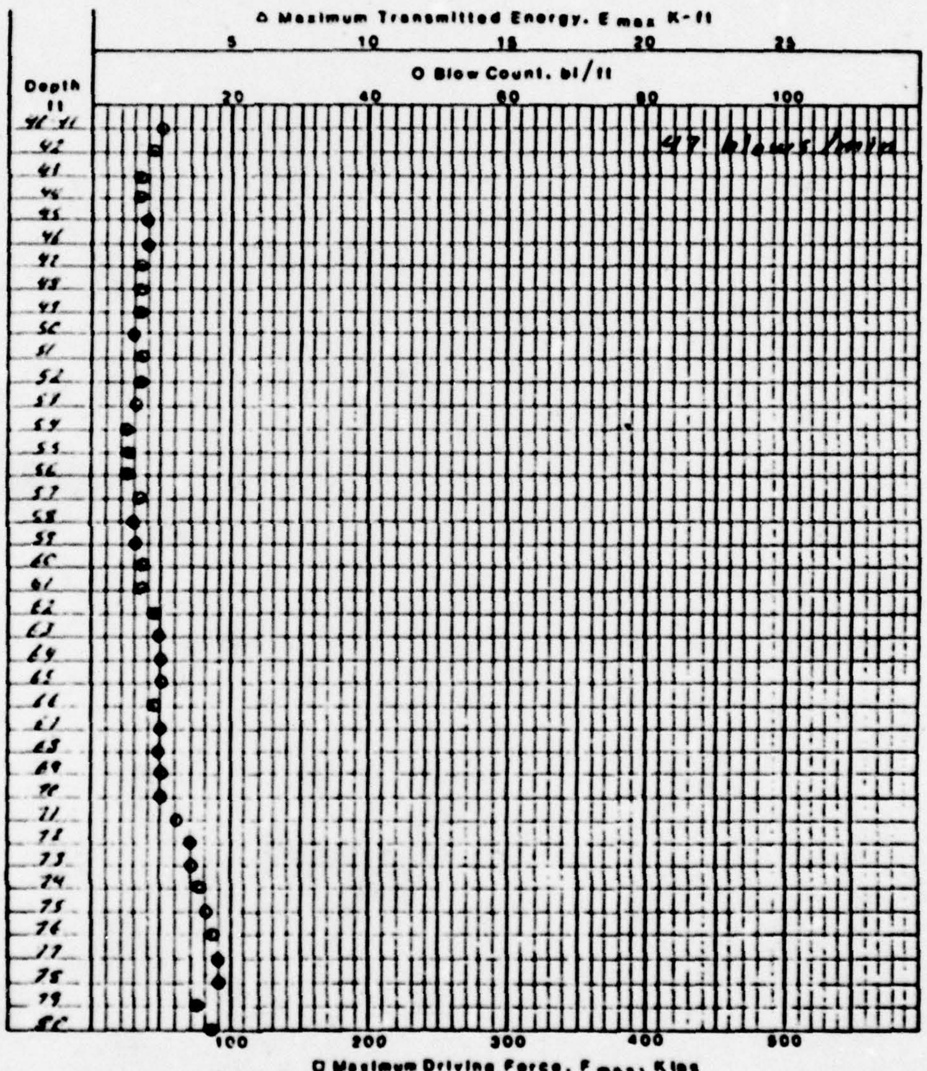
WCC. Y7C825. Phase IV, Vol II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 2
I.D. No. 09/ 03/ 180/ 0/02
Date 3/7/79
Operator DA

PILE DRIVING MEASUREMENTS
PILE NO. 02

	Time	Sequence No.
First		
Finish		



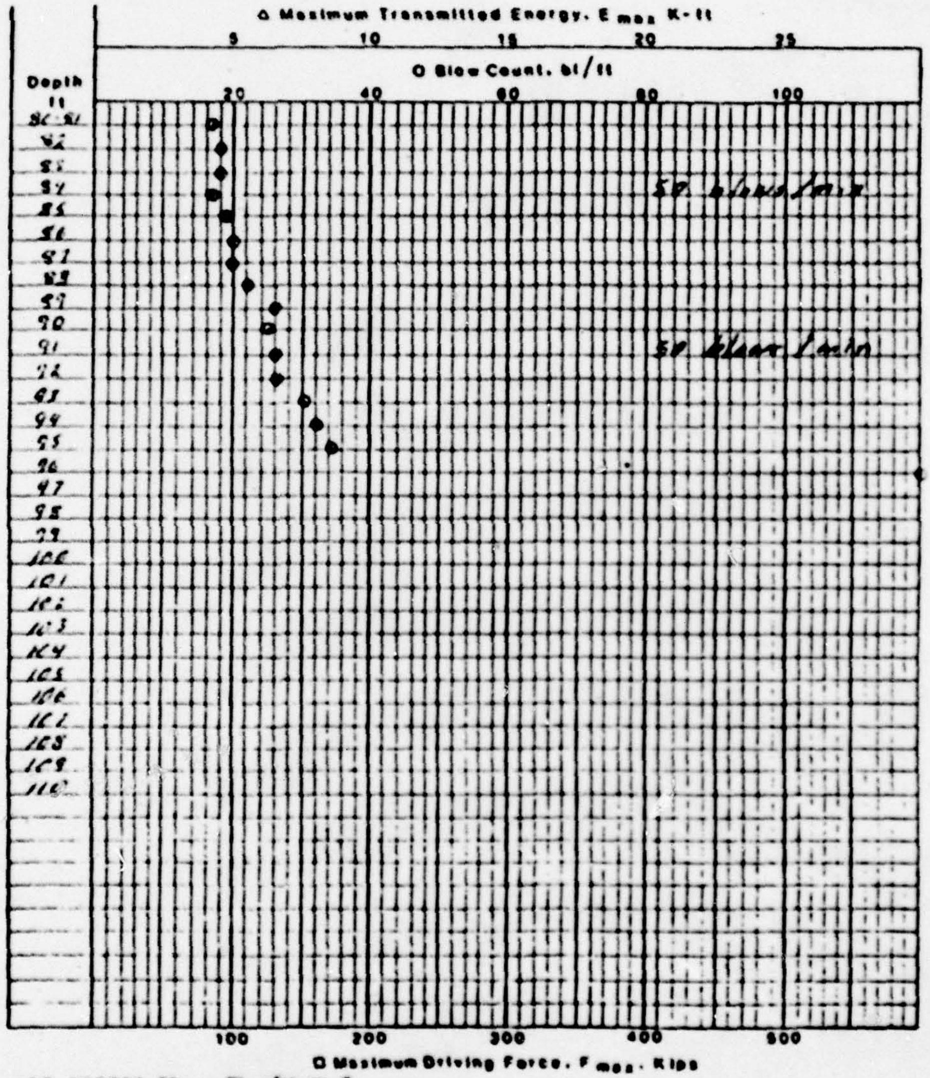
WCC. Y7C825. Phase II ; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 3 of 3
I.D. No. 09 A3 100 0 0
Date 3/2/7
Operator DH

PILE DRIVING MEASUREMENTS
PILE NO. 02

	Time	Sequence No.
First		
Finish		



WCC. 77C825. Phase IV ; VOL II A

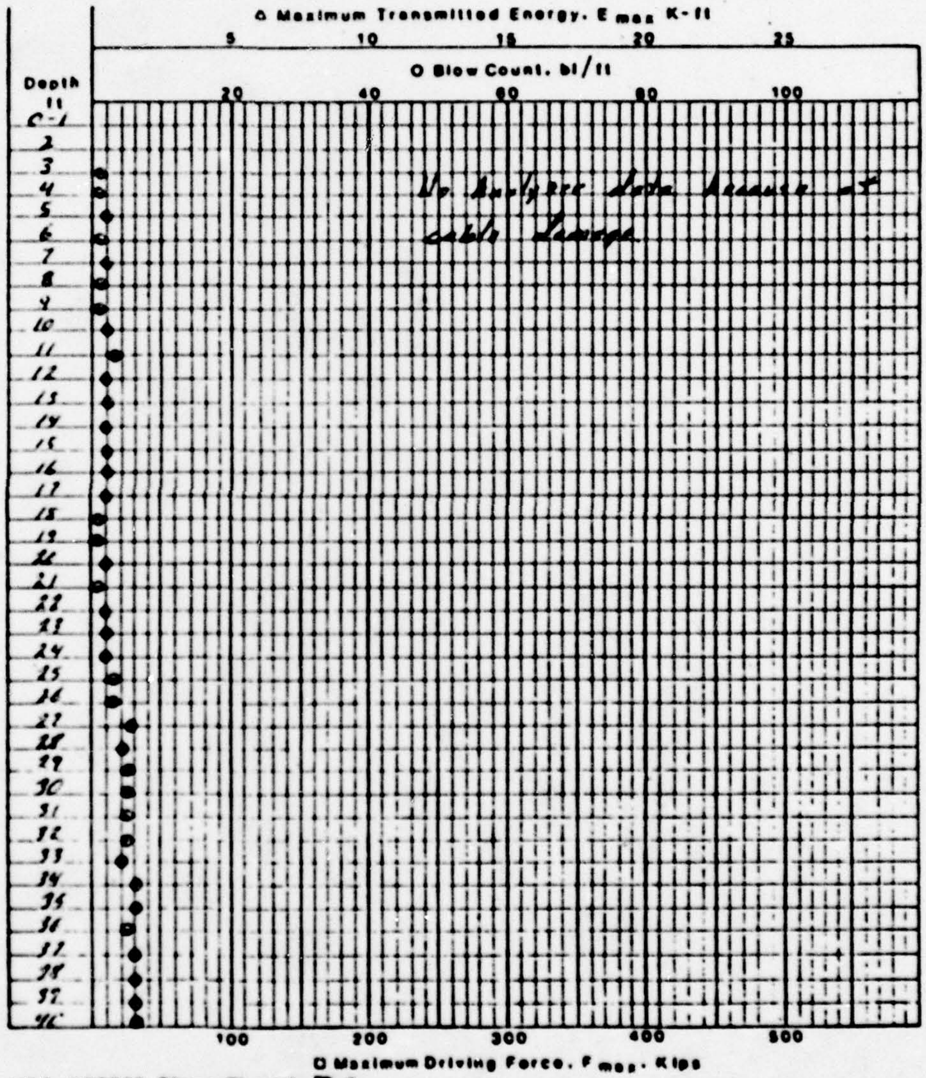
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 3
I.D. No. 09 05 180 0 0300
Date 3/3/79
Operator AZ

PILE DRIVING MEASUREMENTS

PILE NO. 03

	Time	Sequence No.
First		
Finish		



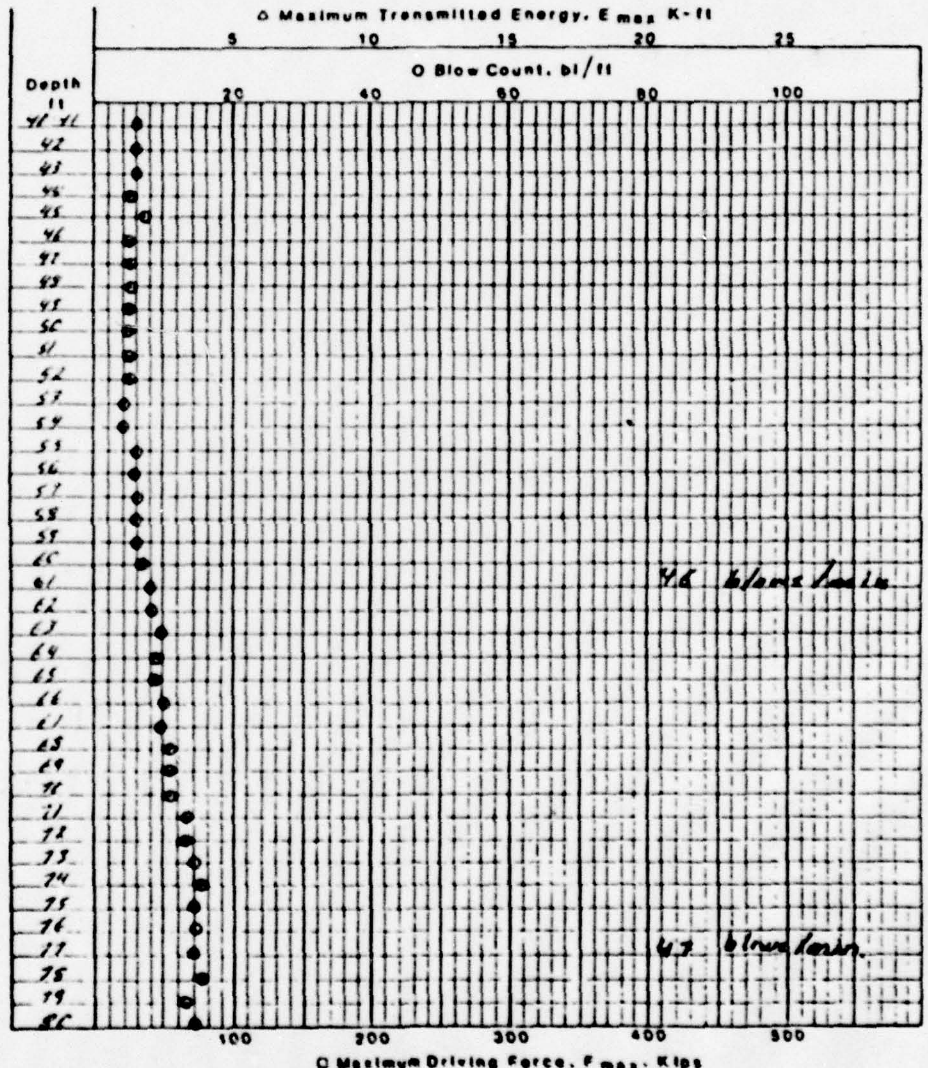
WCC. Y7C825. Phase IV ; VOL IIIA

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 5
I.D. No. 09 03 180 0 030
Date 3/3/79
Operator AZ

PILE DRIVING MEASUREMENTS
PILE NO. 03

	Time	Sequence No.
First		
Finish		



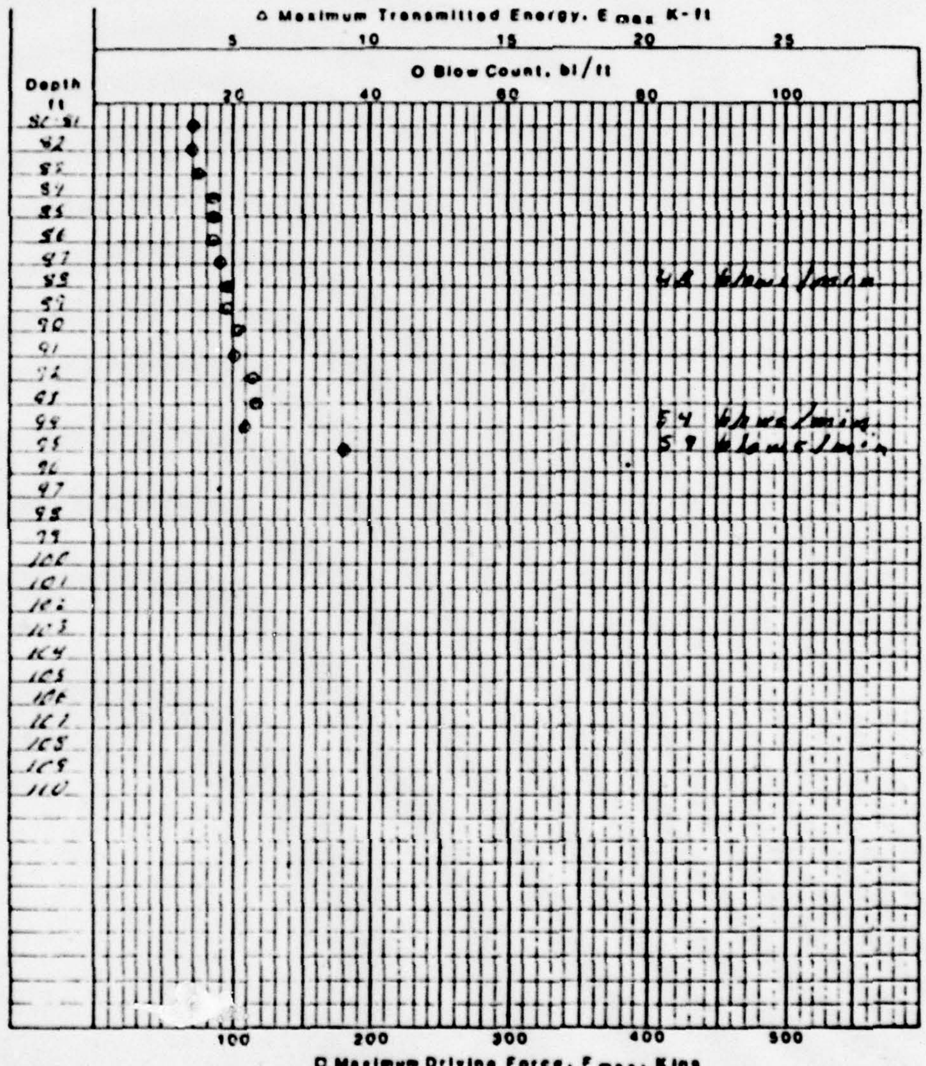
WCC. 77C825. Phase II, Vol. III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 3 of 3
I.D. No. 19 03 180 0 030
Date 3/3/79
Operator AZ

PILE DRIVING MEASUREMENTS
PILE NO. 03

	Time	Sequence No.
First		
Finish		



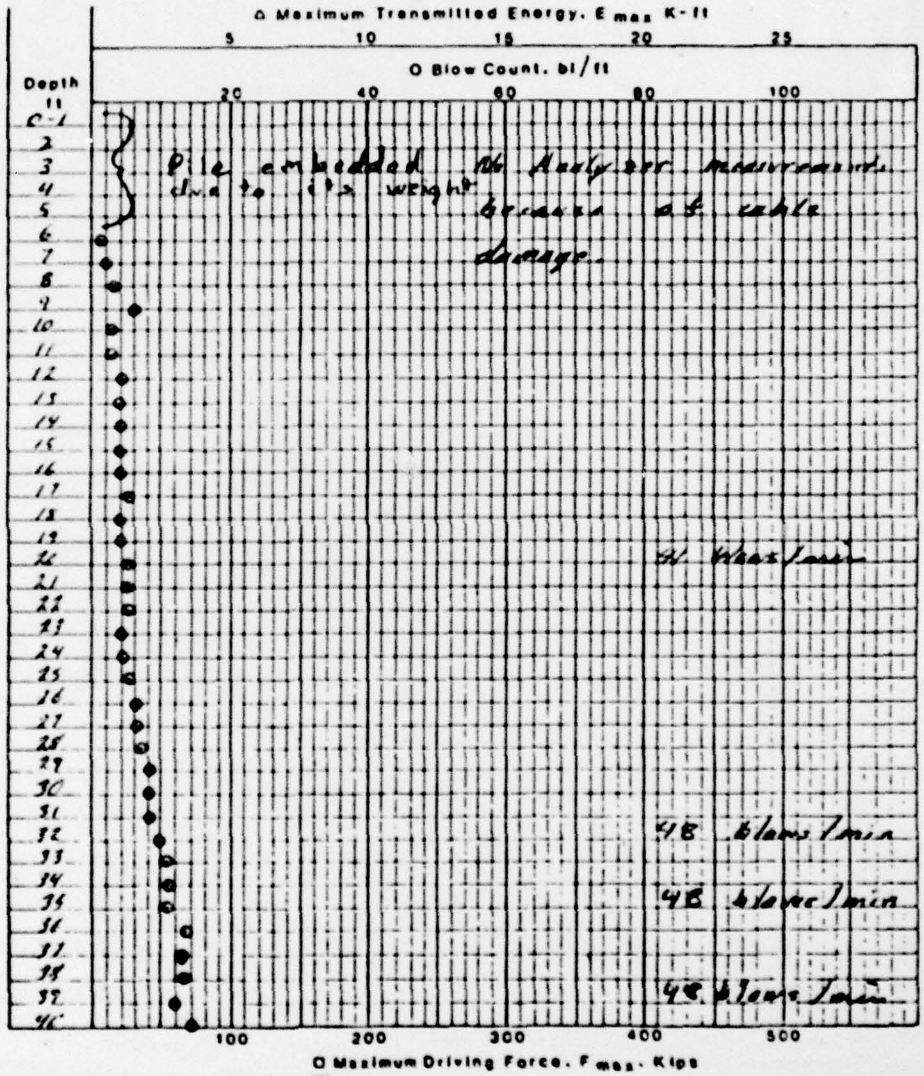
WCC. Y7C825. Phase IV; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 3
I.D. No. 09 03 180 0 04
Date 3/2/7
Operator

PILE DRIVING MEASUREMENTS
PILE NO. 04

	Time	Sequence No.
First		
Finish		



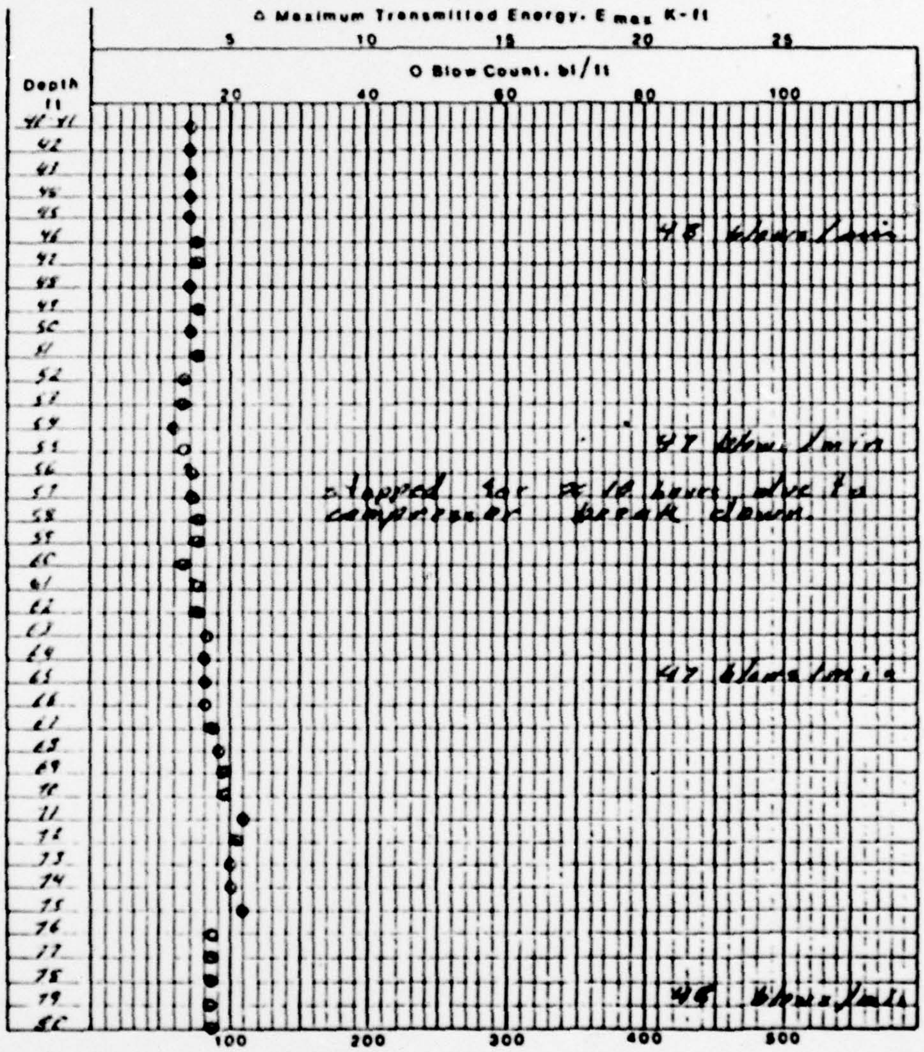
WCC. Y7C825. Phase IV; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 3
I.D. No. 09 03 180 D 040
Date 3/8/79
Operator DA

PILE DRIVING MEASUREMENTS
PILE NO. 84

	Time	Sequence No.
First		
Finish		



WCC. Y7C025. Phase IV, Vol. II A

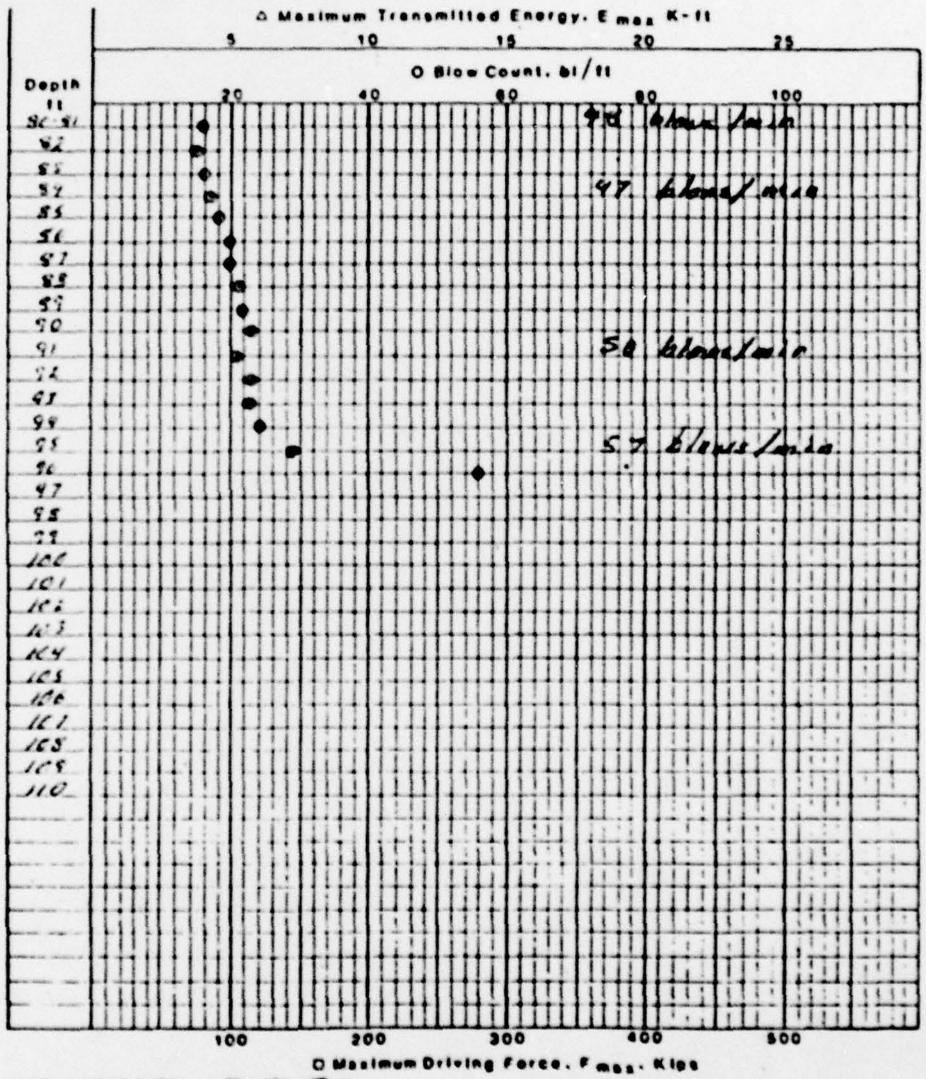
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 3 of 5
I.D. No. 09 03 180 0 040
Date 3/13/79
Operator RR

PILE DRIVING MEASUREMENTS

PILE NO. 04

	Time	Sequence No.
First		
Finish		



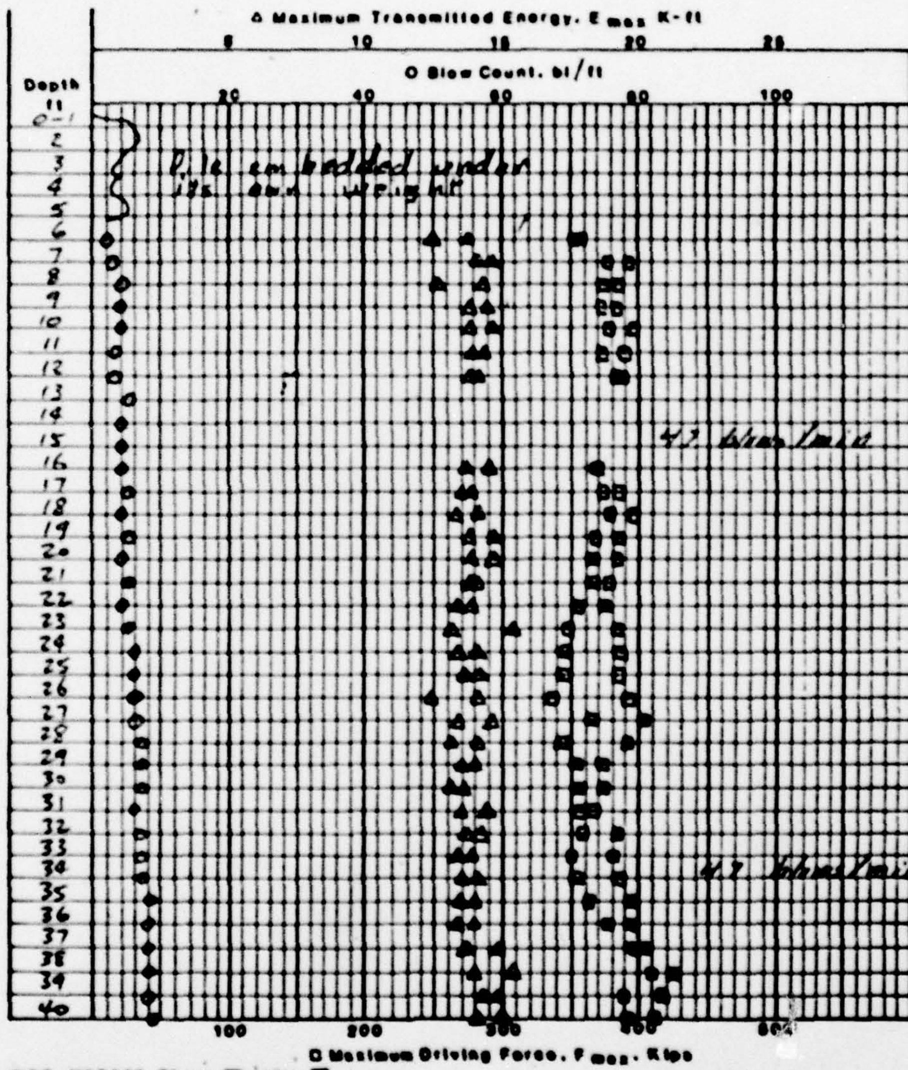
WCC. Y7C825. Phase IV ; VOL. III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 3
I.D. No. 09 03 180 0 [redacted] 0500
Date 3 Mar 79
Operator JSL

PILE DRIVING MEASUREMENTS
PILE NO. [redacted] 05

	Time	Sequence No.
First	1846	0501
Finish	23:56	0509



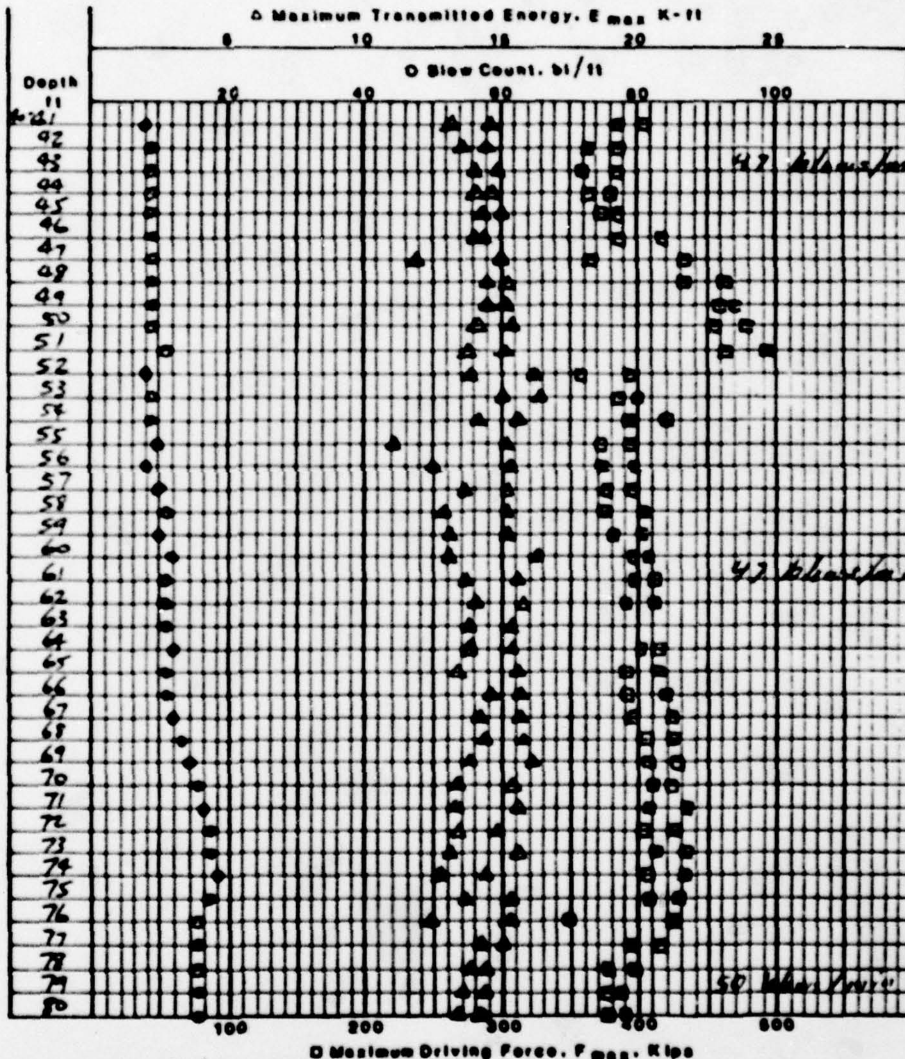
WCC. 77C825. Phase III ; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 3
I.D. No. 09 03 180 0 ~~0400~~ 050
Date 3/3/79
Operator JSL

PILE DRIVING MEASUREMENTS
PILE NO. ~~0~~405

	Time	Sequence No.
First		
Finish		



WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

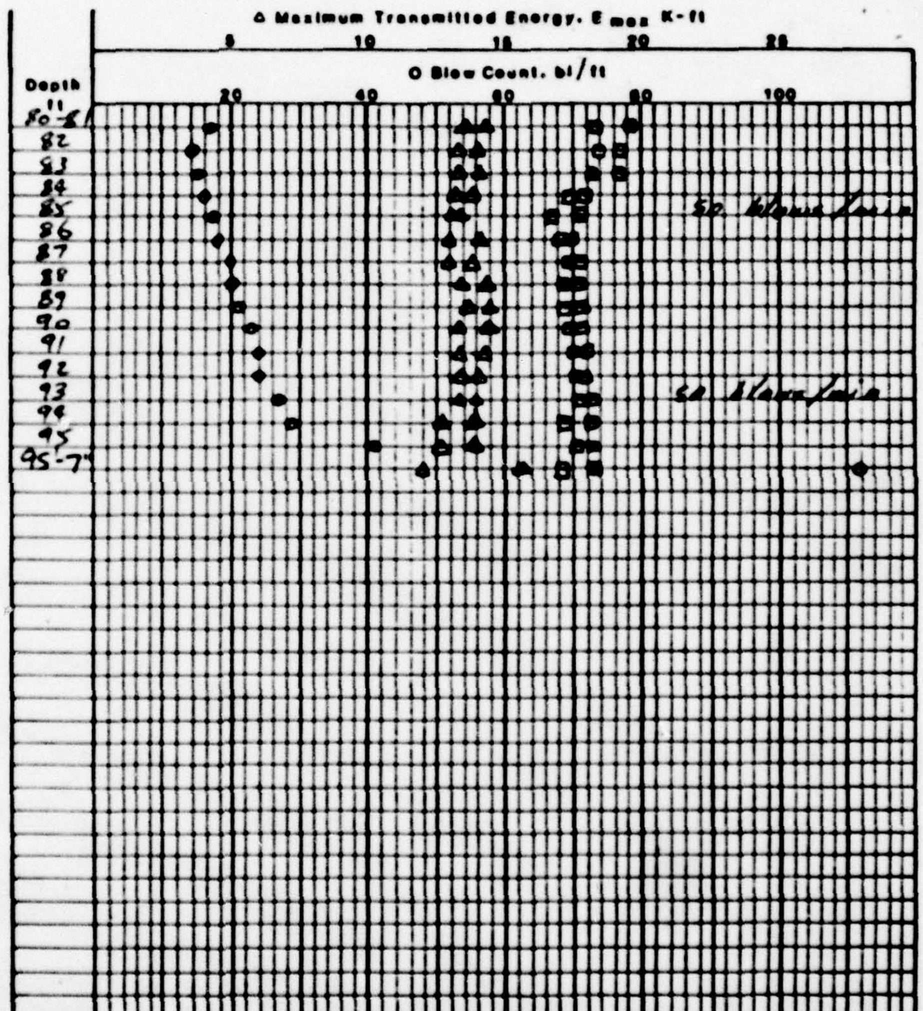
P.___ of___
I.D. No. 09 03 ~~10~~ 0 ~~0~~ 05

Date 7/3/79

Operator JSL

PILE DRIVING MEASUREMENTS
PILE NO. ~~01~~ 05

	Time	Sequence No.
First		
Finish		



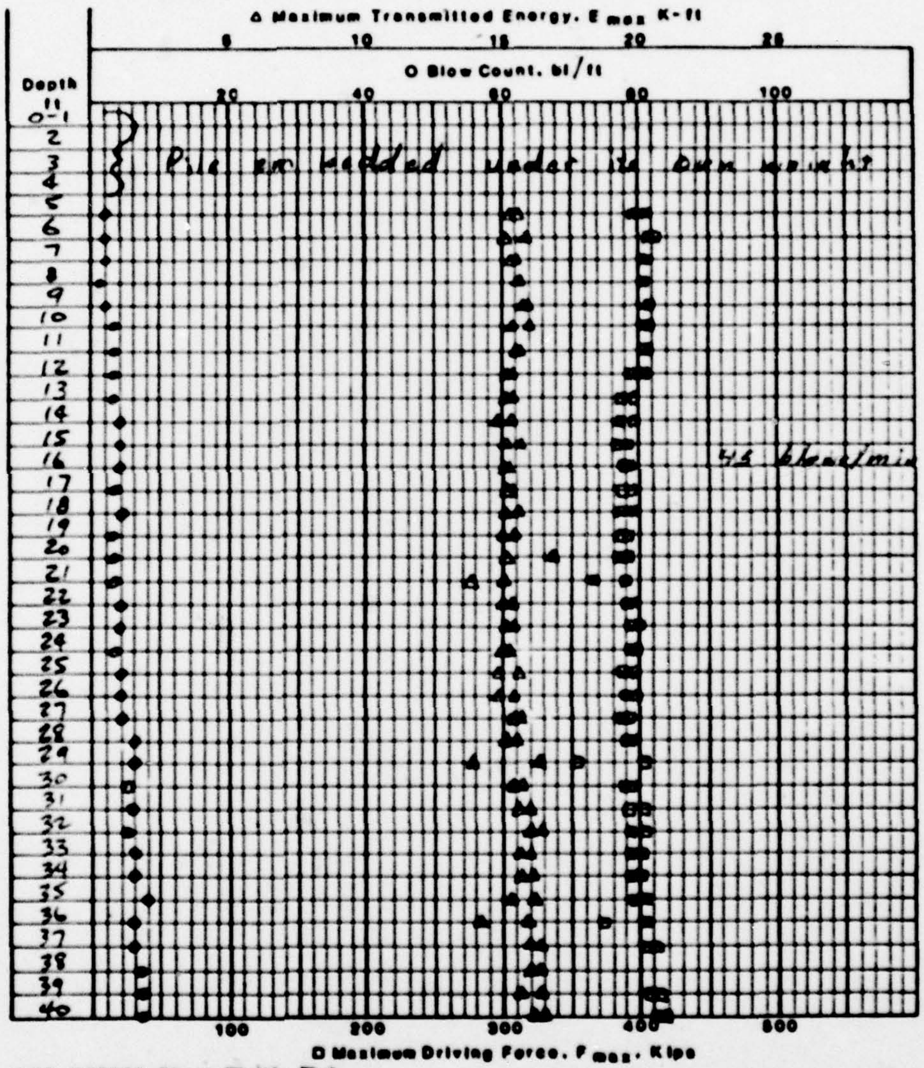
WCC. Y7C028. Phase III, VOL II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

p. 1 of 3
I.D. No. 09 03 180 0 0600
Date 3/6/79
Operator JSL

PILE DRIVING MEASUREMENTS
PILE NO. 06
15' M3

	Time	Sequence No.
First	14:35	0601
Finish		060



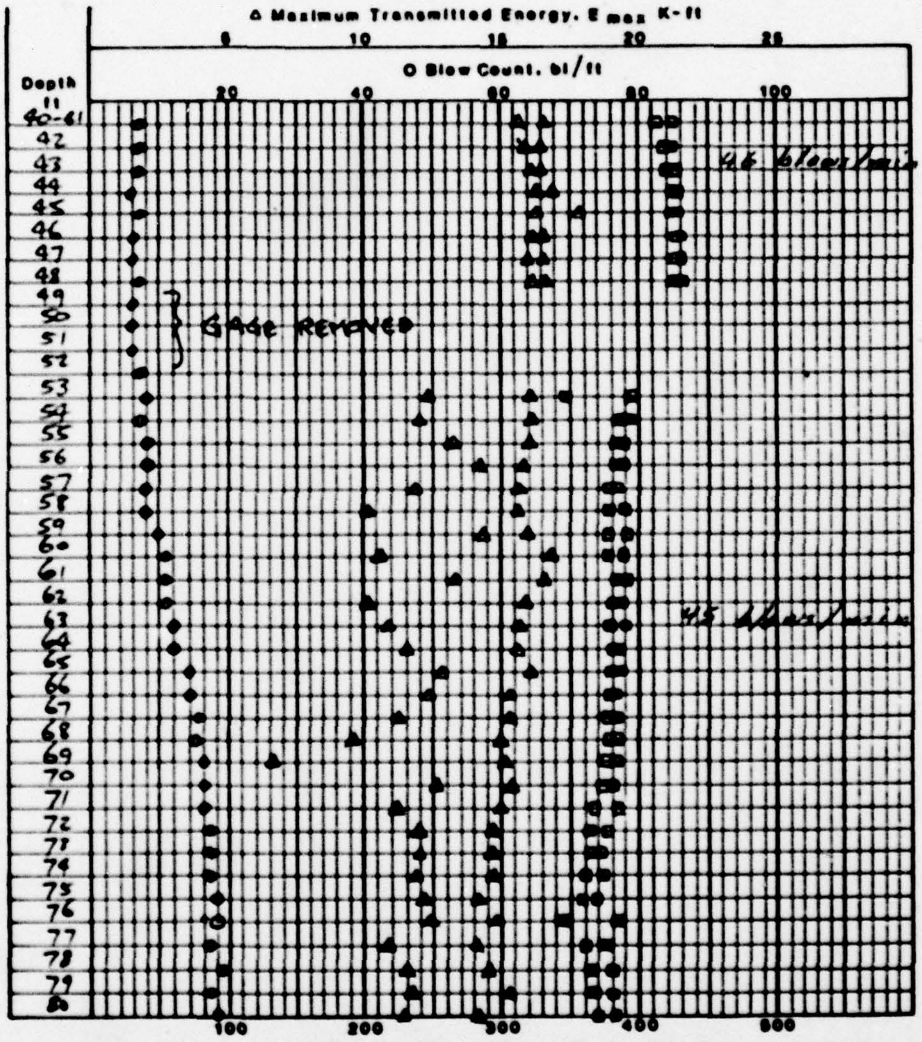
WCC. Y7C628. Phase III; Vol. II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 3
I.D. No. 09 03 180 0 0600
Date
Operator

PILE DRIVING MEASUREMENTS
PILE NO. 06

	Time	Sequence No.
First		
Finish		



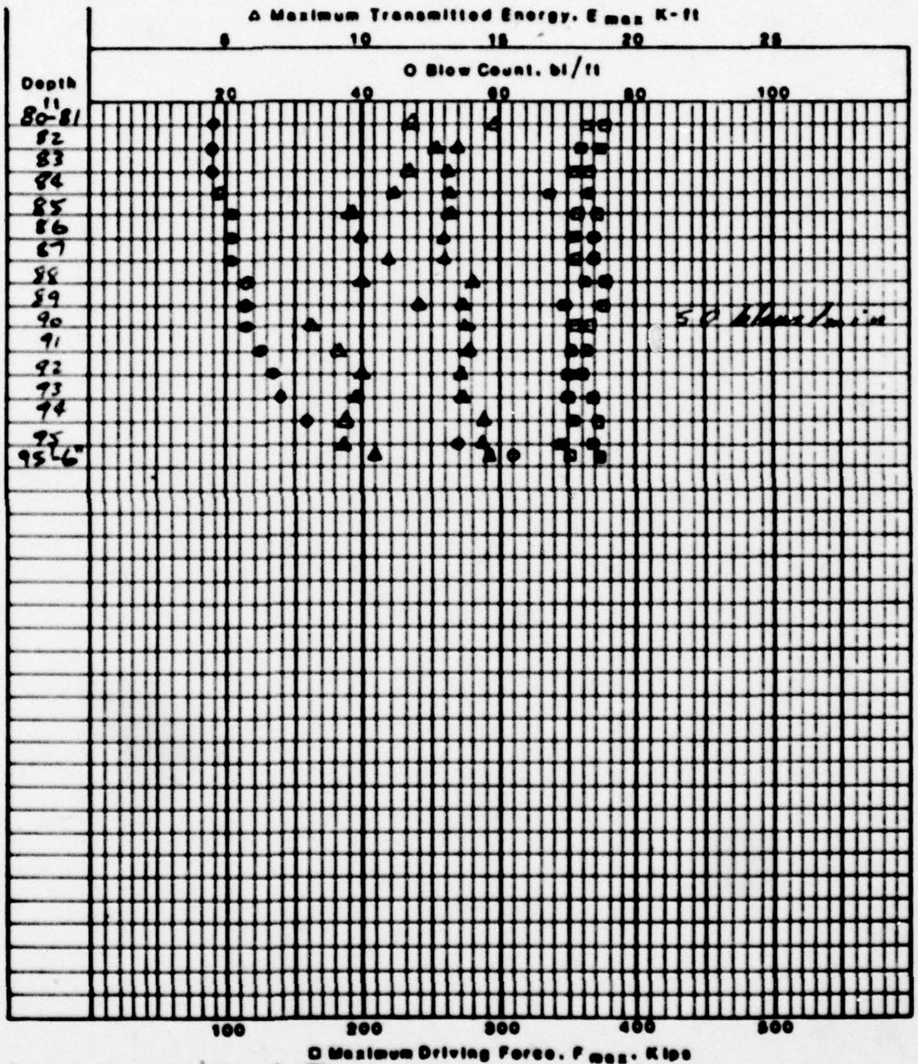
WCC. 77C828. Phase III; Vol IIIA

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 3 of 3
I.D. No. 09 03 180 0 0600
Date______
Operator______

PILE DRIVING MEASUREMENTS
PILE NO. 06

	Time	Sequence No.
First		
Finish		



WCC. 77C026. Phase III, Vol. III A

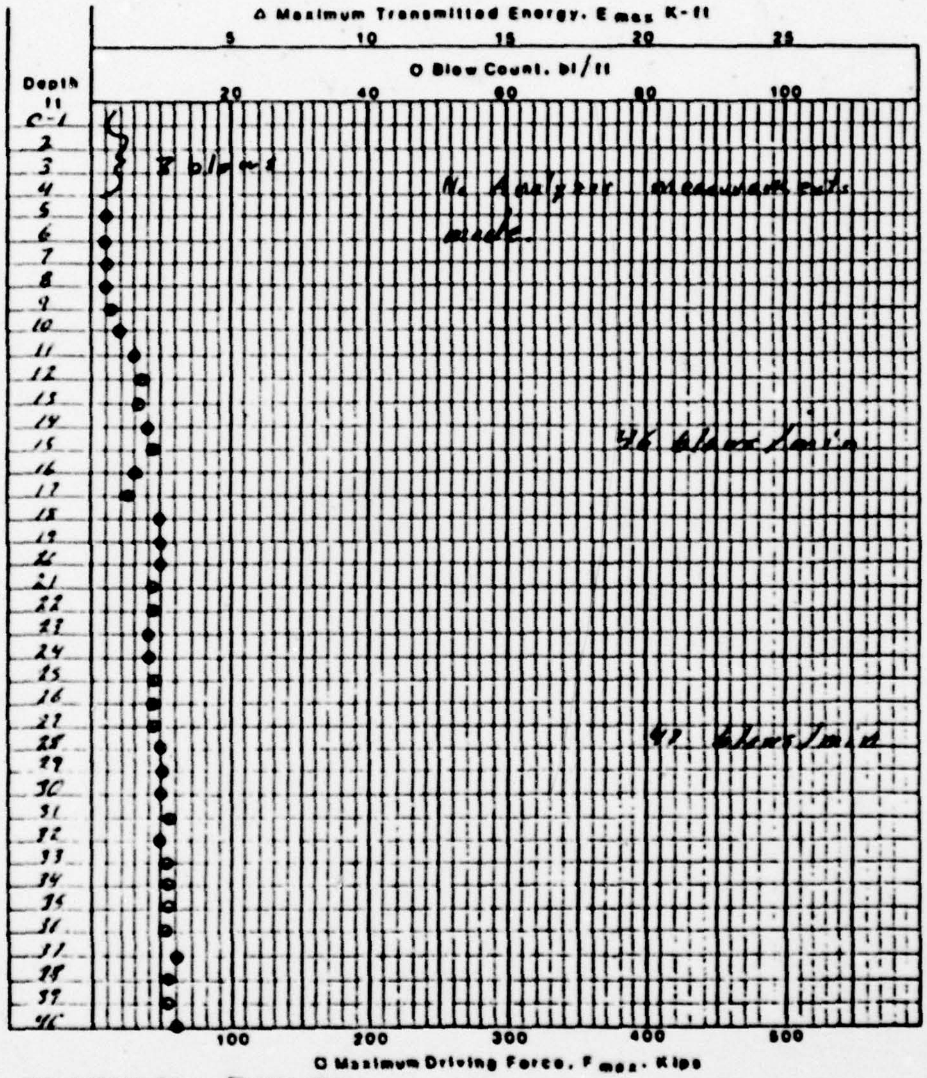
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 2
I.D. No. 09 / 03 / 100 / 1 / 0709
Date 3/6/79
Operator DA

PILE DRIVING MEASUREMENTS

PILE NO. 07

	Time	Sequence No.
First		
Finish		



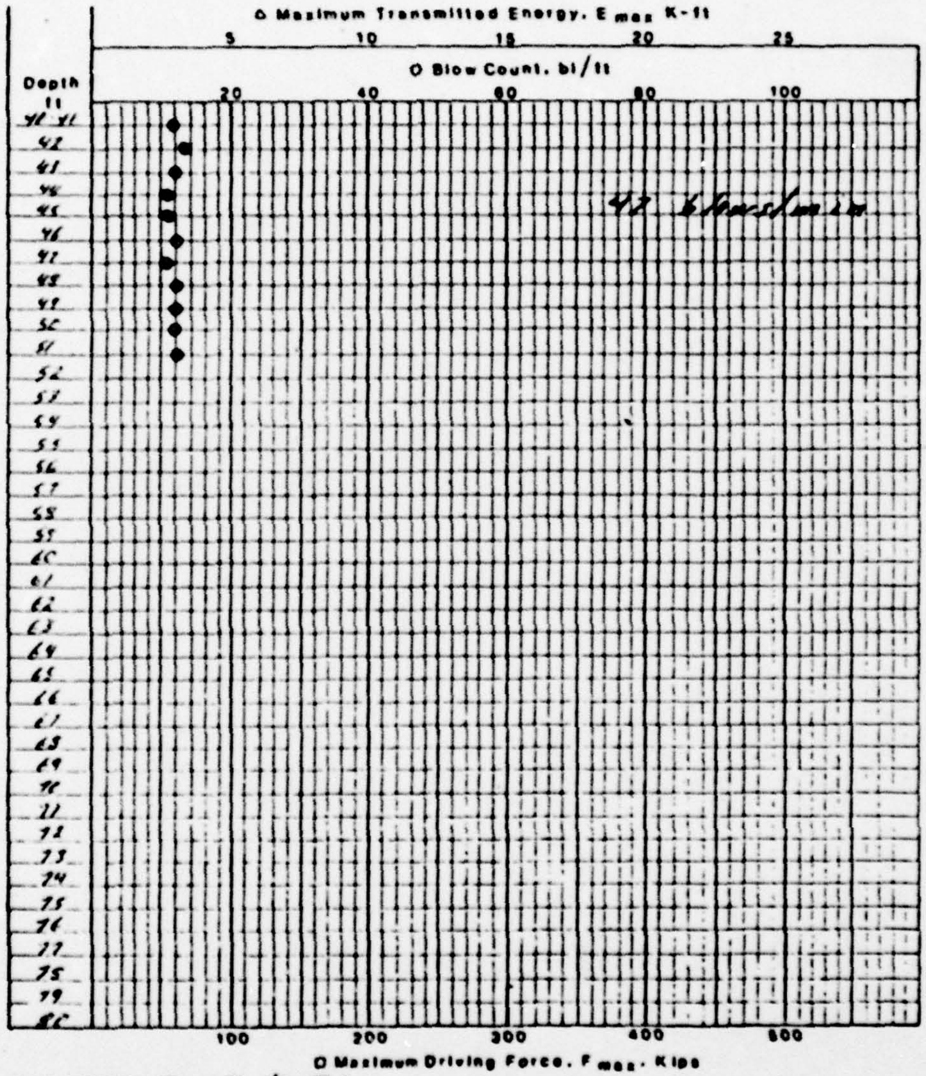
WCC. Y7C825. Phase IV; VOL IIA

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 2
I.D. No. 09/03/180/1/0700
Date 3/6/70
Operator 01

PILE DRIVING MEASUREMENTS
PILE NO. 47

	Time	Sequence No.
First		
Finish		



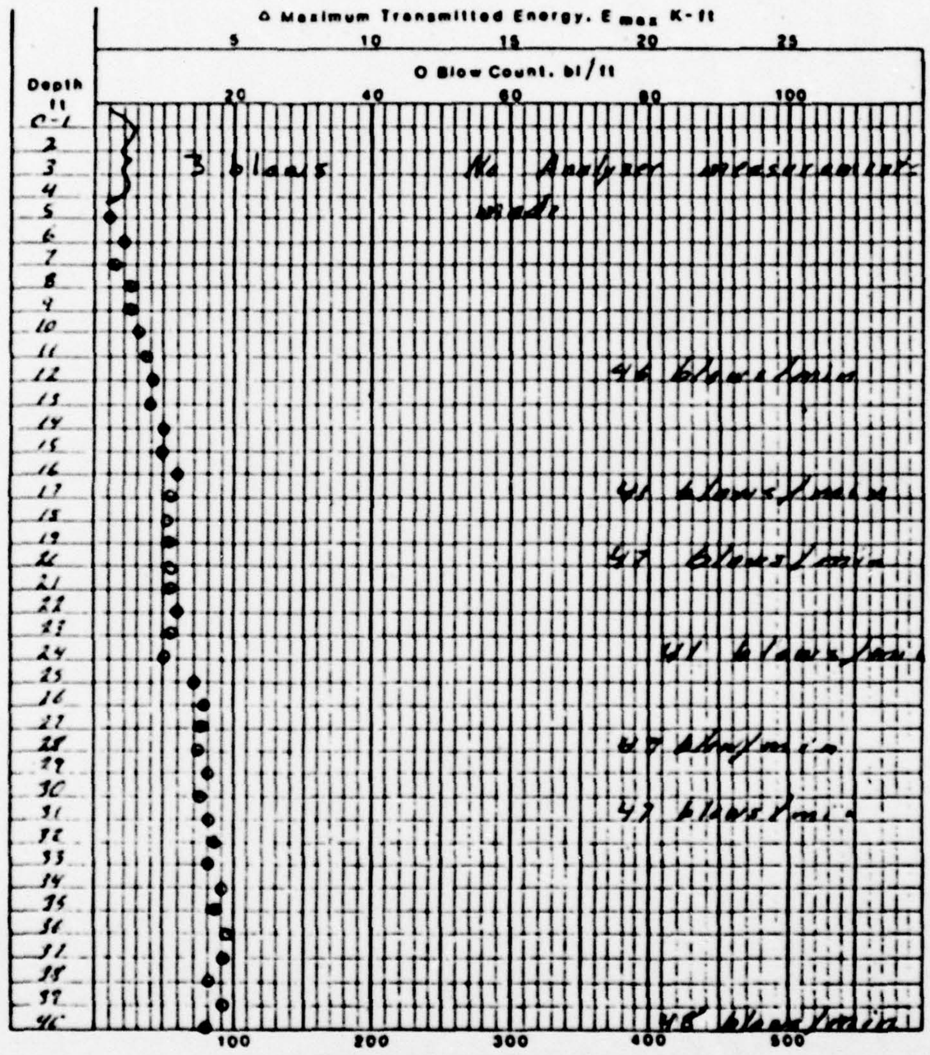
WCC. Y7C825. Phase II ; Vol. II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 2
I.D. No. 09/03/180/1/0800
Date 4/3/79
Operator AZ

PILE DRIVING MEASUREMENTS
PILE NO. 08

	Time	Sequence No.
First		
Finish		

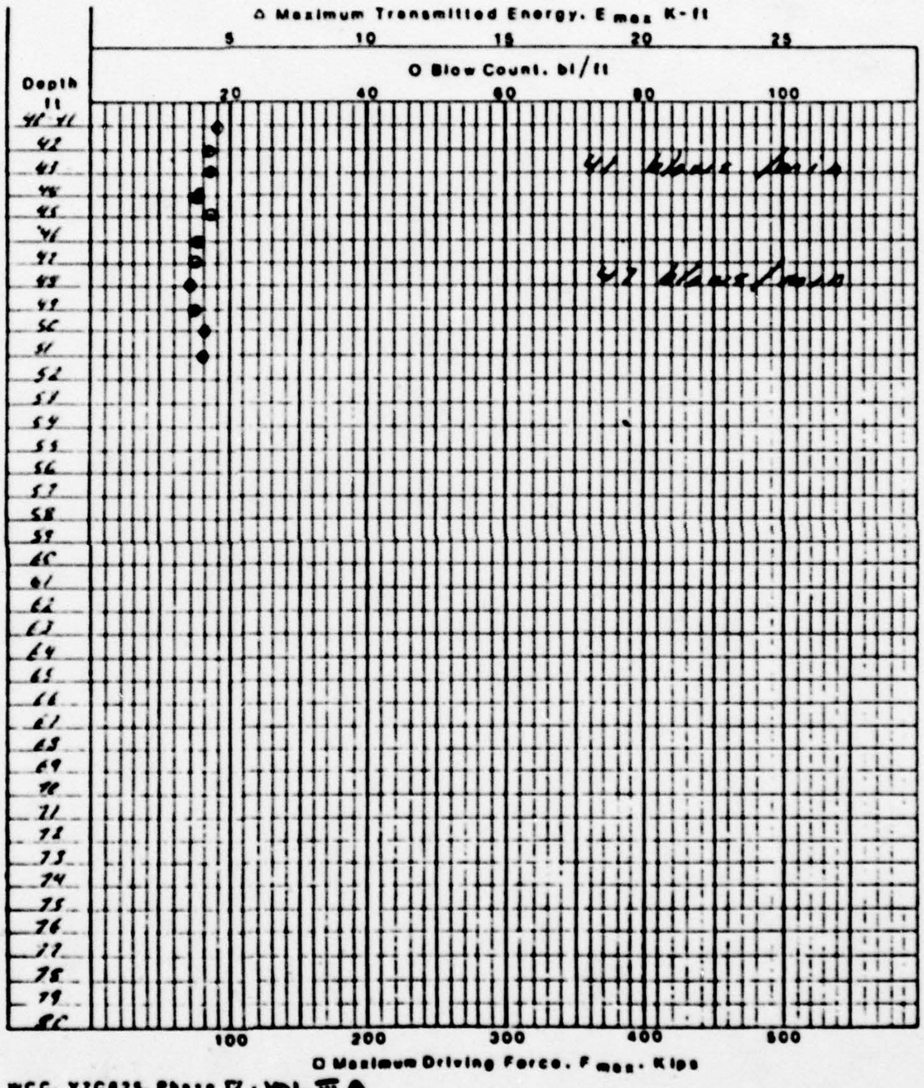


WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 2
I.D. No. 09/03/160/1/0800
Date 4/3/79
Operator AZ

PILE DRIVING MEASUREMENTS
PILE NO. 88

	Time	Sequence No.
First		
Finish		



WCC. 77C825. Phase IV; VOL III A

N.6 ABSOLUTE DISPLACEMENTS OF MONOLITH M3

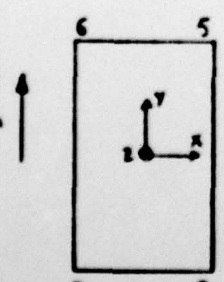
The absolute displacements of monolith during prototype pile driving, presented in Table N.1 are with respect to the position of monolith, completely unloaded, before prototype pile driving.

The absolute displacements of monolith, presented in Table N.2 are with respect to initial monolith position before preloading (no load applied); therefore, these displacement values represent total monolith displacements throughout the tests.

0302	165	240.3	47.7	1.058	1.125	1.158	1.083	1.106	-0.390	-
3/03/14:00	3/03/16:08			1.019	1.091	1.119	1.038	1.049	-0.380	-
0305	181	241.3	47.4	1.187	1.199	1.256	1.209	1.213	-0.480	-
3/03/18:00	3/03/20:30			1.090	1.095	1.225	1.157	1.142	-0.443	-
0402	192	242.8	47.4	1.180	1.232	1.309	1.266	1.247	-0.510	-
3/03/23:20	3/04/01:37			1.130	1.120	1.270	1.199	1.180	-0.503	-
0403	532	241.8	47.6	1.202	1.257	1.334	1.258	1.266	-0.500	-
3/05/08:00	3/05/09:30			1.137	1.130	1.283	1.200	1.188	-0.497	-
0405	549	240.3	47.7	1.279	1.339	1.414	1.335	1.342	-0.540	-
3/05/16:30	3/05/15:57			1.199	1.178	1.356	1.268	1.250	-0.538	-
0502	562	238.4	47.7	1.288	1.360	1.393	1.298	1.335	-0.570	-
3/05/22:00	3/05/23:10			1.217	1.199	1.352	1.261	1.258	-0.536	-
0504	570	240.8	47.2	1.307	1.374	1.481	1.399	1.390	-0.600	-
3/06/00:30	3/06/01:31			1.246	1.233	1.436	1.331	1.311	-0.581	-
0504	626	240.8	47.6	1.365	1.437	1.535	1.461	1.449	-0.650	-
3/06/08:00	3/06/08:19			1.281	1.266	1.459	1.378	1.346	-0.621	-
0504	635	249.2	47.7	1.412	1.469	1.519	1.462	1.466	-0.675	-
3/06/12:00	3/06/13:29			1.334	1.303	1.454	1.386	1.369	-0.617	-
0604	648	195.6	47.5	1.450	1.478	1.556	1.502	1.497	-0.660	-
3/06/16:00	3/06/16:49			1.341	1.310	1.505	1.417	1.393	-0.644	-
0606	655	119.4	47.8	1.572	1.603	1.712	1.648	1.635	-0.750	-
3/06/21:00	3/06/22:35			1.473	1.442	1.650	1.564	1.532	-0.770	-
0703	665	128.3	47.6	1.777	1.820	1.915	1.823	1.834	-0.830	-
3/07/00:30	3/07/01:31			1.625	1.622	1.794	1.701	1.685	-0.861	-

	Y-Component, in.			Z-Component, in.							Remarks
	7	8	Y	5	6	56	7	8	78	Z	
Optical Survey Data											
Corrected Cyber Data											
13	0.928	0.897	0.886	-0.260	-0.230	-0.245	0.000	-0.070	-0.035	-0.140	
24	0.881	0.815	0.829	-0.238	-0.203	-0.218	+0.002	-0.060	-0.029	-0.123	
26	0.962	0.874	0.909	-0.270	-0.240	-0.255	-0.020	-0.080	-0.050	-0.152	
42	0.915	0.840	0.857	-0.251	-0.225	-0.238	0.003	-0.067	-0.039	-0.135	
12	1.074	0.965	0.994	-0.300	-0.270	-0.285	-0.050	-0.110	-0.080	-0.183	
61	1.101	0.967	0.984	-0.340	-0.239	-0.290	-0.065	-0.093	-0.079	-0.184	
38	1.052	0.974	1.008	-0.290	-0.280	-0.285	-0.070	-0.150	-0.110	-0.198	
				-0.297	-0.254	-0.276	-0.084	-0.120	-0.102	-0.189	
25	1.130	1.053	1.077	-0.290	-0.320	-0.305	-0.090			-0.233	No reading of Z8
08	1.081	0.996	1.017	-0.319	-0.280	-0.300	-0.098	-0.125	-0.112	-0.206	
36	1.127	1.020	1.059	-0.380	-0.360	-0.370	-0.100	-0.160	-0.130	-0.250	
92	1.069	0.986	1.005	-0.364	-0.321	-0.342	-0.093	-0.137	-0.115	-0.229	
25	1.138	1.033	1.106	-0.390	-0.360	-0.375	-0.100	-0.170	-0.135	-0.255	
21	1.119	1.032	1.049	-0.380	-0.333	-0.357	-0.110	-0.158	-0.134	-0.245	
19	1.256	1.209	1.213	-0.480	-0.440	-0.460	-0.140	-0.250	-0.195	-0.328	
95	1.225	1.157	1.142	-0.443	-0.391	-0.417	-0.150	-0.191	-0.171	-0.294	
32	1.309	1.266	1.247	-0.510	-0.480	-0.495	-0.160	-0.280	-0.220	-0.358	
20	1.270	1.199	1.180	-0.503	-0.434	-0.469	-0.167	-0.211	-0.189	-0.329	
37	1.334	1.258	1.266	-0.500	-0.470	-0.485	-0.170	-0.260	-0.215	-0.350	
130	1.283	1.200	1.188	-0.497	-0.451	-0.474	-0.186	-0.232	-0.209	-0.342	
39	1.414	1.335	1.342	-0.540	-0.510	-0.525	-0.170	-0.290	-0.230	-0.378	New calibers used from this sequence on
78	1.356	1.268	1.250	-0.538	-0.477	-0.508	-0.199	-0.248	-0.224	-0.366	
60	1.393	1.298	1.335	-0.570	-0.540	-0.555	-0.210	-0.330	-0.270	-0.413	
99	1.352	1.261	1.258	-0.536	-0.479	-0.508	-0.235	-0.279	-0.257	-0.382	
74	1.481	1.399	1.390	-0.600	-0.560	-0.580	-0.280	-0.370	-0.325	-0.453	
33	1.436	1.331	1.311	-0.581	-0.518	-0.550	-0.309	-0.450	-0.380	-0.465	
37	1.535	1.461	1.449	-0.650	-0.620	-0.635	-0.240	-0.380	-0.310	-0.473	
66	1.459	1.378	1.346	-0.621	-0.553	-0.587	-0.221	-0.281	-0.251	-0.419	
69	1.519	1.462	1.466	-0.675	-0.620	-0.648	-0.170	-0.255	-0.213	-0.430	
03	1.454	1.386	1.369	-0.617	-0.575	-0.596	-0.192	-0.244	-0.218	-0.407	
78	1.556	1.502	1.497	-0.660	-0.630	-0.645	-0.170	-0.290	-0.230	-0.438	
10	1.505	1.417	1.393	-0.644	-0.593	-0.619	-0.183	-0.247	-0.215	-0.417	
03	1.712	1.648	1.635	-0.750	-0.720	-0.735	-0.220	-0.350	-0.285	-0.510	
42	1.650	1.564	1.532	-0.770	-0.691	-0.731	-0.278	-0.427	-0.352	-0.541	
20	1.915	1.823	1.834	-0.830	-0.790	-0.810	-0.180	-0.370	-0.275	-0.543	
22	1.794	1.701	1.685	-0.861	-0.687	-0.774	-0.270	-0.421	-0.346	-0.560	
51	1.952	1.856	1.862	-0.920	-0.870	-0.895	-0.210	-0.350	-0.280	-0.588	
61	1.839	1.744	1.765	-1.041	-1.044	-1.042	-0.231	-0.303	-0.267	-0.655	
065	2.177	2.123	2.101	-1.070	-1.080	-1.075	-0.220	-0.370	-0.295	-0.685	Printer malfunctionning
855	2.057	1.979	1.947	-1.098	-1.029	-1.064	-0.275	-0.322	-0.299	-0.681	(no value of V)

ect
th



PILE DRIVING EFFECTS TEST PROGRAM

ABSOLUTE DISPLACEMENTS OF MONOLITH M3 DURING PROTOTYPE PILE DRIVING

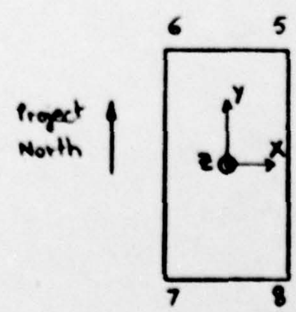
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS

Woodward-Clyde Consultants

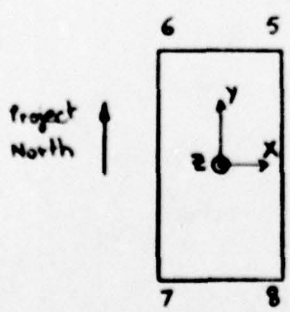
VYCOPS Phase II ; Vol III A

Table N.1

Displacements	Horizontal displacement, in.						
	5	6	7	8	Average	5	6
	Reference point data Corrected linear potentiometer data						
at the end of preloading (monolith axially and laterally unloaded)	0.576	0.626	0.650	0.573	0.606	0.199	0.135
prior to prototype pile driving (monolith axially and laterally loaded)	1.375	1.450	1.531	1.386	1.436	0.431	0.33
at the end of prototype pile driving (monolith axially and laterally loaded)	2.474	2.481	2.707	2.552	2.554	1.297	1.164
prior to load testing (monolith axially and laterally unloaded)	1.707	1.741	1.917	1.802	1.791	1.091	1.001



	Horizontal displacement, in.			Settlement, in.						
	7	8	Average	5	6	North Average	7	8	South Average	Average
Reference point data										
Corrected linear potentiometer data										
6	0.650	0.573	0.606	0.199	0.135	0.167	0.001	0.054	0.028	0.097
30	1.531	1.386	1.436	0.431	0.338	0.385	-0.001	0.114	0.057	0.221
1	2.707	2.552	2.554	1.297	1.164	1.231	0.276	0.376	0.326	0.778
	1.917	1.802	1.791	1.091	1.001	1.046	0.291	0.458	0.375	0.711



1 2

PILE DRIVING EFFECTS TEST PROGRAM

ABSOLUTE DISPLACEMENTS OF MONOLITH M3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
[illegible]

Woodward-Clyde Consultants
[illegible] Phase III ; VOL II A

Table N.2

Y7C-825
Phase IV ; VOL III A

N.7 INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR PROTOTYPE PILES OF MONOLITH M3

Monoliths M3/7, Prototype Pile No. 1 Pile Type HP 14x73
Final Pile Penetration 106.6 ft

Sequence No.		0101			0102			0103			0104			0105		
Pile Penetration ft		1'			25'			52'			70'			90'		
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1																
2	M1		V			V			V			V			V	
3	~~M4~~															
4	M2															
5																
6	M3															
7	F1		X			X			X			X			X	
8																
9	F2		X			X			X			X			X	
10	G6-15			X			X			X			X			X
11	F3		X			X			X			X			X	
12	G6-50															
13	G7-1		X			X			X			X			X	
14	G12-1		V	X		V	X		V	X		V	X		V	X
15	G7-15			X			X			X			X			X
16	G12-15															
17	G7-50			X			X			X			X			X
18	G12-50															

Monoliths M3/7, Prototype Pile No. 2, Pile Type HP 14x73
Final Pile Penetration 95.6 ft

Sequence No.		0201			0202			0203			end of pile					
Pile Penetration ft		1			25			52			95'7"					
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1																
2	M1		V			V			X							
3	M4									X						
4	M2								X							
5																
6	M3								X							
7	F1			X			X			O						
8																
9	F2			X			X		V	O						
10	G6-15			X			X			O						
11	F3		X			X			V	X						
12	G6-50															
13	G7-1		X			X			X							
14	G12-1		V	X		V	X		O	O						
15	G7-15		X			X			O	X						
16	G12-15															
17	G7-50		X			X			O	X						
18	G12-50															

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component

SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITHS M3/7 PROTOTYPE PILES No. 1 and 2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-[illegible]

Woodward-Clyde Consultants
77C029 Phase III ; Vol. VI A

Monoliths M3/7, Prototype Pile No. 3 Pile Type HP 14x73
Final Pile Penetration 95.7 ft

Sequence No.		0301			0302			0303			0304			0305		
Pile Penetration - ft		2'			25'			52			70			80/95'8"		
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1																
2	M1		V			V			V			X			V	
3	M4												X			
4	M2											X				
5																
6	M3											X				
7	F1			X			X			X		V				X
8																
9	F2			X			X			X						X
10	G6-15			X			X			X						X
11	F3		X			X			X				X		X	
12	G6-50															
13	G7-1		X			X			X			X			X	
14	G12-1		V	X		V	X		V	X		V			V	X
15	G7-15		X			X			X				X		X	
16	G12-15															
17	G7-50		X			X			X				X		X	
18	G12-50															

Monoliths M3/7, Prototype Pile No. 4, Pile Type HP 14x73
Final Pile Penetration 86.1 ft

Sequence No.		0401			0402			0403			0404			0405		
Pile Penetration - ft		4'8"			25'8"			51'8"			57'10"			75'/86'1		
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1																
2	M1		V			V			X			V			V	
3	M4									X						X
4	M2								X							
5																
6	M3								X							
7	F1			X			X		V							X
8																
9	F2			X			X	dead								
10	G6-15			X												X
11	F3		X			X			V	X		X	X		X	
12	G6-50															
13	G7-1		X			X			X			X	X		X	
14	G12-1			X								V			V	X
15	G7-15						X			X		X	X		X	
16	G12-15															
17	G7-50						X			X		X	X		X	
18	G12-50															

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component
SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITHS M3/7 PROTOTYPE PILES No. 3 and 4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-[illegible]

Woodward-Clyde Consultants
77C020 Phase II; VOL III A

Monoliths M3/7, Prototype Pile No. 5 Pile Type HP 14x73
Final Pile Penetration 95.6 ft

Sequence No.		0501			0502			0503			0504			End of Pile		
Pile Penetration ft		5			25'3"			51			75			95'7"		
Junction Box Channel	Geophone No.	Osc.	Tape	SA	Osc.	Tape	SA	Osc.	Tape	SA	Osc.	Tape	SA	Osc.	Tape	SA
1																
2	M1		V			V			X							
3	M4			X			X			X			X			
4	M2								X							
5																
6	M3								X							
7	F1			X			X		V				X			
8																
9	~~F2~~															
10	G6-15			X			X									
11	F3		X			X			V	X		X				
12	G6-50															
13	G7-1		X			X			X			X				
14	G12-1		V	X		V	X									
15	G7-15		X			X				X			X			
16	G12-15															
17	G7-50		X			X				X			X			
18	G12-50															

Monoliths M3/7, Prototype Pile No. 6, Pile Type HP 14x73
Final Pile Penetration 95.5 ft

Sequence No.		0601			0602			0603			0604			0605		
Pile Penetration ft		4			20			35			52'1"			75		
Junction Box Channel	Geophone No.	Osc.	Tape	SA	Osc.	Tape	SA	Osc.	Tape	SA	Osc.	Tape	SA	Osc.	Tape	SA
1																
2	M1		V			V			V			X			V	
3	M4			X			X			X			X			X
4	M2											X				
5																
6	M3											X				
7	F1			X			X			X		V				X
8																
9	~~F2~~															
10	G6-15			X			X			X						X
11	F3		X			X			X			V	X		X	
12	G6-50															
13	G7-1		X			X			X			X			X	
14	G12-1		V	X		V	X		V	X					V	X
15	G7-15		X			X			X				X		X	
16	G12-15															
17	G7-50		X			X			X				X		X	
18	G12-50															

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component
SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITHS M3/7 PROTOTYPE PILES No. 5 and 6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-[illegible]

Woodward-Clyde Consultants

[illegible] Phase III ; Vol. II A

Monoliths M3/7, Prototype Pile No. 7 Pile Type HP 14 x 73
Final Pile Penetration 50.25 ft

Sequence No.		0701			0702			0703			end of pile					
Pile Penetration - ft		3'6"			20			35			50'3"					
Junction Box Channel	Geophone No.	Osc.	Tape	SA	Osc.	Tape	SA	Osc.	Tape	SA	Osc.	Tape	SA	Osc.	Tape	SA
1																
2	M1		V			V			V							
3	M4			X			X			X						
4	M2															
5																
6	M3															
7	F1			X			X			X						
8																
9	~~F2~~															
10	G6-15			X			X			X						
11	F3		X			X			X							
12	G6-50															
13	G7-1		X			X			X							
14	G12-1		V	X		V	X		V	X						
15	G7-15		X			X			X							
16	G12-15															
17	G7-50		X			X			X							
18	G12-50															

Monoliths M3/7, Prototype Pile No. 8 Pile Type PP 14 x 0.375
Final Pile Penetration 50.75 ft

Sequence No.		0801			0802											
Pile Penetration - ft		3'10"			25			50'9"								
Junction Box Channel	Geophone No.	Osc.	Tape	SA	Osc.	Tape	SA	Osc.	Tape	SA	Osc.	Tape	SA	Osc.	Tape	SA
1																
2	M1		V			V										
3	M4			X			X									
4	M2															
5																
6	M3															
7	F1			X			X									
8																
9	F2															
10	G6-15			X			X									
11	F3		X			X										
12	G6-50															
13	G7-1		X			X										
14	G12-1		V	X		V	X									
15	G7-15		X			X										
16	G12-15															
17	G7-50		X			X										
18	G12-50															

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component

SA or PVM: Peak Vibration Monitor
Osc.: Oscillograph
Tape: Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITHS M3/7 PROTOTYPE PILES No. 7 and 8

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0000

Woodward-Clyde Consultants

77C020 Phase III; VOL II A

Y7C-825
Phase IV ; Vol III A

N.8 INFORMATION DIGITIZED FROM ANALOG MAGNETIC TAPE FOR MONOLITH M3

Geophone No.	Prototype Pile No and Depth of Digitization (ft)							
	1	2	3	4	5	6	7	8
G7-1		50	55			50 70	50	
G7-15		50	55			50	50	
G7-50		50	55			50	50	
F3		50	55			50		
MG1						70		
MG2						70		
MG3						70		

Depth of Digitization is the prototype pile tip depth at which the digitized data recorded during the tests on analog magnetic tape, were processed through a computer.

PILE DRIVING EFFECTS TEST PROGRAM
INFORMATION DIGITIZED FROM ANALOG MAGNETIC TAPE FOR MONOLITHS M3 & M7

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-[illegible]

Woodward-Clyde Consultants
77C029 Phase [illegible] \ VOL [illegible] A

PHASE IV REPORT

VOLUME IIIA

RESULTS AND INTERPRETATION OF
PILE DRIVING EFFECTS TEST PROGRAM

APPENDIX O

MEASUREMENT DETAILS
MONOLITH M5

TABLE OF CONTENTS

Y7C-825
Phase IV; Vol III A

0 MEASUREMENT DETAILS, MONOLITH M5

0.1 COMPLETE FIELD LOGS OF INSTALLATION OF TIMBER PILES UNDER MONOLITH M5

The identification number (Id. No.) at the top right-hand corner of each data sheet includes the timber pile number shown in Fig. 5.2, Volume III.

The timber pile number is given by the two digits preceeding the last two zeros of the Id. No. (for example, page 0-2 corresponds to timber pile No. 44)

The field logs are presented in chronological order of timber pile installation.

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

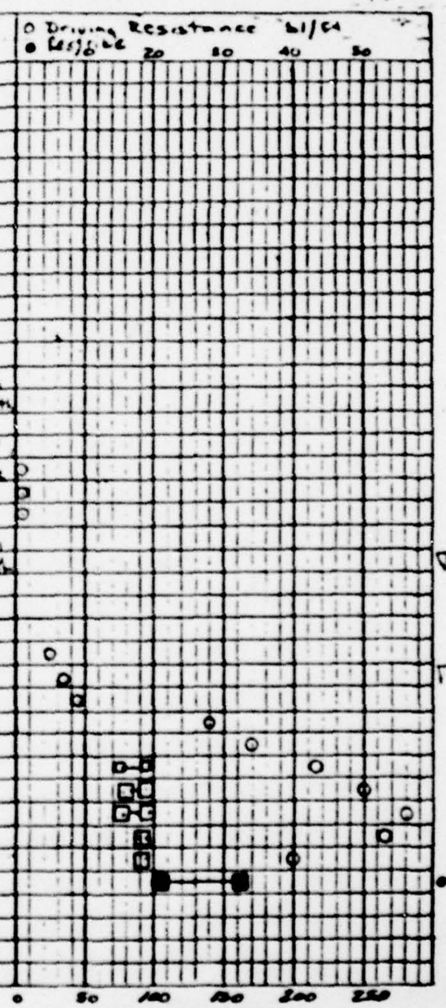
PILE DRIVING RECORD

P. 1 of 1

ID No. 08 05 160 1 4400

Pile Type	Douglas fir	Hammer	Vulcan V1	Date	11/1/78
Pile length	45'	Energy	15,000 ftlbs	Time	18:10 to 19:10
Ground el.	trench level	Operating Rate	60 bl/min	Inspector	D. A[illegible]

Depth ft	Blows	Remarks
0-1		18:10 Prejetted to 21'
2		
3		Pile embedded to 17'6"
4		under its own weight
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		Organic matter seen in
15		return wash 14-18' depth
16		
17		Pile embedded to 17'8"
18	1	18:28 After 3 blows pile
19	1	had walked 6" W
20	1	Jetted on east side to 22'
21		Clay seams and lenses in
22		wash around 20-25' depth
23		
24		Pile sunk
25		
26	5	
27	7	
28	9	
29	28	
30	34	18:46
31	43	
32	50	
33	56	
34	53	
35	20/6"	19:10
	61 for 6"	restrike on 11/2/78
		at 10:20 AM



Dynamic measurements yes

Sequence No.	Depth ft
01 (PDA)	30'-34'6"
02 restrike (PDA)	34'6"-35'

Notes:
Pile batter at E.O.D.
1.9% N
4.0% E

□ Capacity, Kips
■ Restrike
▽ Jetting depth

WCC, VTC 815, Phase II, Vol III A

10 Oct '79

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

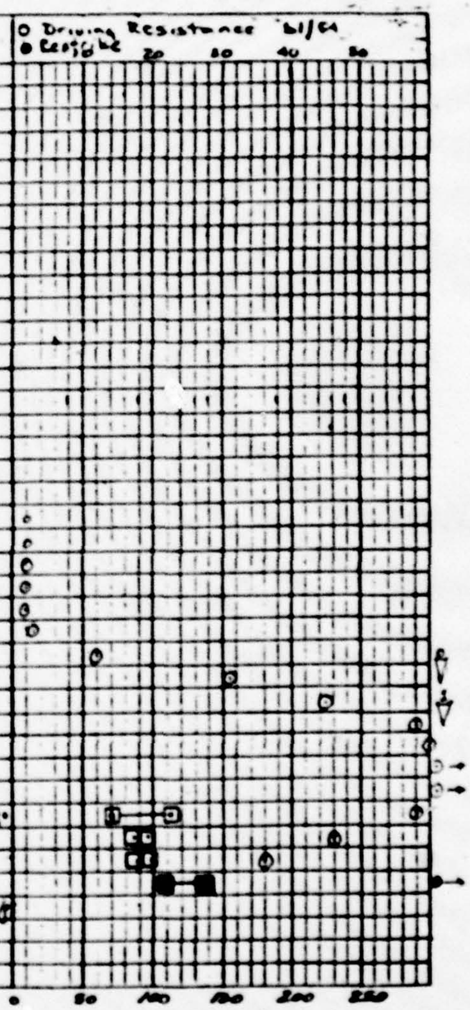
PILE DRIVING RECORD

P. 1 of 1

ID No. 03 05 160 I 43^0

Pile Type Douglas Fir | Hammer Vulcan V1 | Date 11/1/78
Pile length 42' | Energy 15000 ft lbs | Time 19:55
Ground el. Trench level | Operating Rate 60 blows/min | Inspector - D. Aguárcel

Depth ft	Blows	Remarks
0-1		
2		
3		Pre-jetted to 27'
4		Organic matter (gravel
5		sized pieces of lignite)
6		in return (out) when jet
7		tip between 15 and 18
8		feet
9		
10		Pile run to 19'
11		
12		
13		
14		
15		
16		
17		
18		
19	▼	
20	2	
21	2	
22	2	
23	2	
24	2	
25	3	
26	12	
27	31	52 blows/min
28	45	
29	58	
30	60	
31	75	
32	90	52 blows/min, jet - jet tip to
33	58	29 ft. Analyzer 32' → 34.5'
34	46	
35	18 for 6"	Pile tip at 35.65'
	5? for 6"	Restrike, tip to 35.60' on
		11/2/78. Final B/ft 104 blows/ft



Dynamic measurements Yes

Sequence No.	Depth ft
01 (PDA)	32 to 34.5'
02 restrike (PDA)	34.5 to 35

Notes:
Pile batter at E.O.D.
5.1 % S

0.9 % E

□ Capacity, kips
■ Restrike
▽ Jetting depth

WCC, 77C 815, Phase II
Vol II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

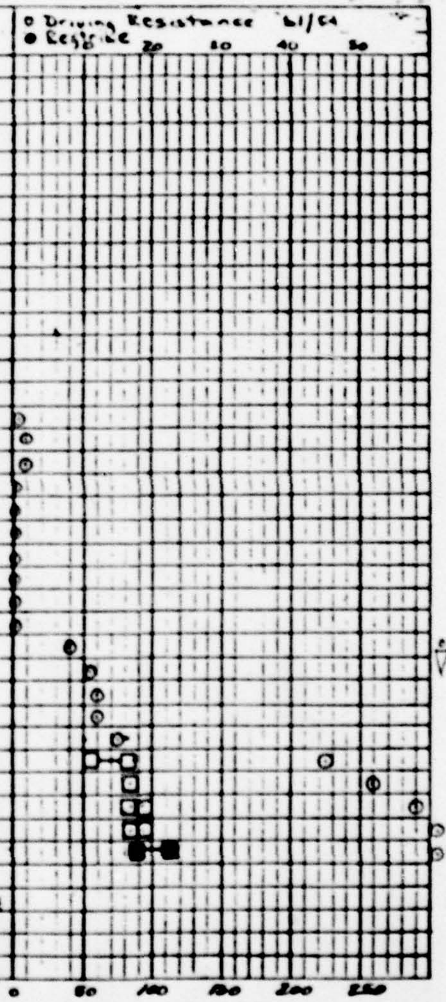
PILE DRIVING RECORD

P. 1 of 1

ID No. 03 05 160 1 4200

Pile Type	Douglas Fir	Hammer	Vulcan VI	Date	11/1/78
Pile length	48'	Energy	15000 ft lbs	Time	22:10
Ground el.	Trench level	Operating Rate	60 blows/min	Inspector	D. Aggarwal

Depth ft	Blows	Remarks
0-1		
2		Pre-jet to 27'
3		
4		Pile run to 27' then
5		slowly back to 22'6".
6		Pile pulled and re-inserted
7		
8		Pile re-run to 15'
9		Very little organic
10		matter seen in return
11		water
12		
13		
14		
15		
16	1	
17	2	
18	2	
19		
20		
21	3 blows	
22		
23		
24		
25		
26	8	
27	11	
28	12	
29	12	
30	15	
31	45	
32	52	
33	58	57 blows/min
34	65	
35	[illegible] 1"	
		Restrike, tip to 35.0'
		11/2/78. Final 6": 125 blows/ft



□ Capacity, kips
■ Restrike
▽ Jetting depth

Dynamic measurements YES

Sequence No.	Depth ft.
01 (PDA)	30 - 34'1"
02 (Restrike)	3

Notes:
Pile batter at E.O.D.
2.9 % S
1.8 % E

WCC, YTC B2S, Phase III
VOL III A

10 Oct '78

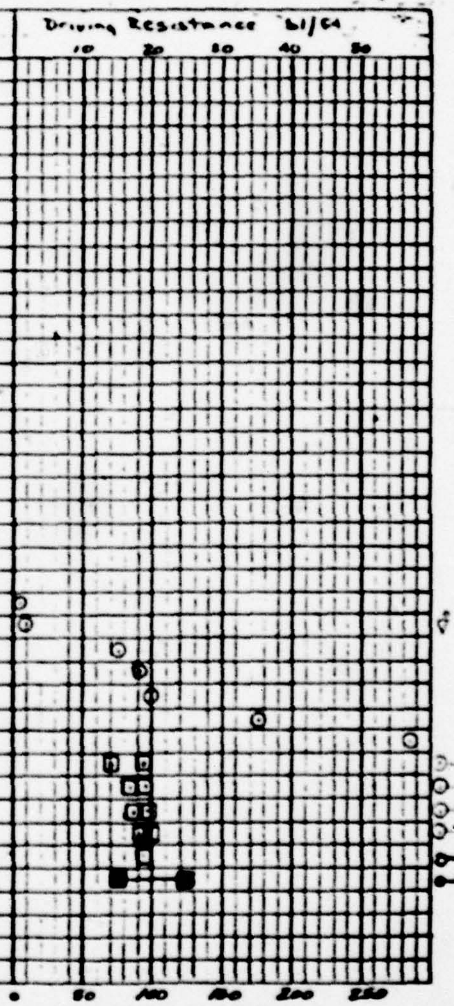
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

P. 1 of 1

ID No. 03 05 T60 T 41^0

Pile Type: Douglas Fir — Hammer: Vulcan VI — Date: 11/1/78
Pile length: 42' — Energy: 15,000 ft lb — Time: 23 15 to 24 00 hr
Ground el.: Trench Level — Operating Rate: 60 Blows/min — Inspector: D. Amiswal

Depth ft	Blows	Remarks
0-1		
2		Pre-jet hole to 25'
3		Pile embedded 19'
4		under its own wt
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		Clay lenses and gravel
15		seen in return wash at
16		14' to 17' depth
17		
18		
19		
20		Organic matter seen
21	3	around 20-22' depth
22		
23		
24	1	
25	2	
26	15	
27	18	
28	20	
29	35	
30	57	
31	64	
32	71	
33	72	
34	72	
35	25 for 6"	
	31 for 6"	Re-strike on 11/2/78 at
		17 25 hrs



□ Capacity, kips
■ Restrike
▼ Jetting depth

Dynamic measurements YES

Sequence No.	Depth ft
01 (PDA)	30 - 34.5
02 (Restrike)	34.5 - 34.5

Notes:
Pile batter at E.O.D.
3.3% S
1.5% E

WCC, VTC B2S, Phase II
Vol III A

J.S.L.
10 Oct '78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

P. 1 of 1

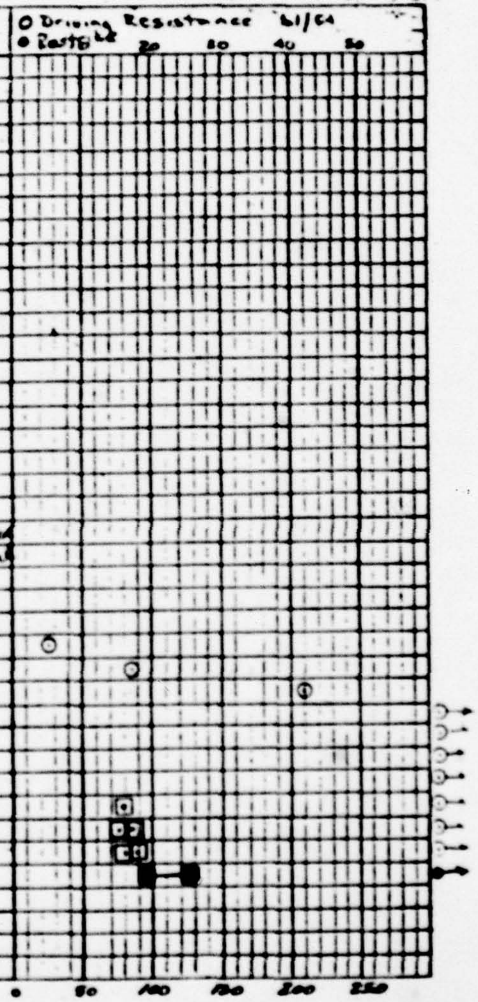
ID No. 03 05 160 1 40^0

Pile Type: Douglas Fir
Pile length: ______
Ground el.: ______

Hammer: Vulcan V1
Energy: 15,000 ft lb
Operating Rate: 60 blows/min

Date: 11/2/78
Time: 00 30 to 01 [illegible]
Inspector: [illegible]

Depth ft	Blows	Remarks
0-1		
2		No jet hole to 25' depth
3		Pile embedded to 5'
4		under its own weight
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		[illegible] seen in
19		[illegible] wood at 18-20'
20		depth
21		Clay [illegible] and [illegible]
22		pieces of granular material
23		[illegible] in [illegible] wood
24		between 20-25' depth
25		
26	5	
27	17	
28	42	
29	67	
30	76	
31	81	
32	89	50 blows/min
33	92	
34	102	
35	107	
	67 for 5.5"	[illegible] on 11/2/78 at
		19 40 [illegible]



Dynamic measurements YES

Sequence No.	Depth ft
01 (PDA)	32 - 35
02 (Restrike PDA)	35.0 - 35.5

Notes:
Pile batter at E.O.D
5.0% S
3.2% E

■ Restrike
▽ Jetting

✓ G.E.L.
10 Oct '78

WCC, 77C 835, Phase II
Vol II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

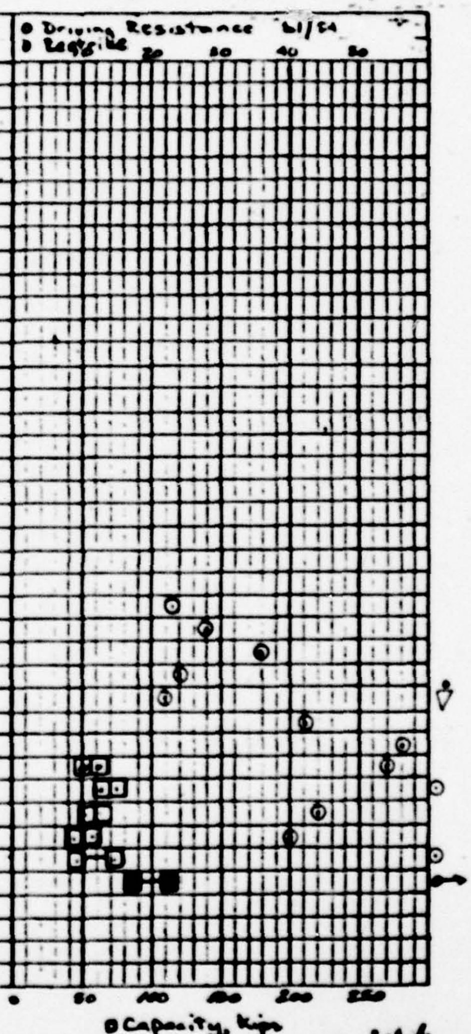
PILE DRIVING RECORD

P. 1 of 1

ID No. 03 05 160 1 3900

Pile Type	Douglas Fir (Treated)	Hammer	Vulcan V1	Date	11/2/78
Pile length	42 ft	Energy	15,000 ft lbs	Time	0715 to 0831
Ground el.	[illegible]	Operating Rate	60 blows/min	Inspector	Bob [illegible]

Depth ft	Blows	Remarks
0-1		
2		Pre-jet to 28' depth
3		Pile sank to 19' depth
4		
5		Repeat in [illegible] [illegible]
6		[illegible] [illegible] to [illegible] [illegible]
7		depth
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21	3 blows	
22		
23		
24	23	
25	28	
26	36	
27	24	
28	22	
29	42	
30	56	
31	54	
32	64	
33	44	
34	40	
35	40 for 7"	
	40 for 6"	Re-strike on 11/2/78 at
		19 [illegible] hrs



Dynamic measurements YES

Sequence No.	Depth ft
01 (PDP)	30 - 30.5
02 (restrike)	30.5 - 35.0

Notes:
Pile batter at E.O.D.
0.9% S
3.5% E

[illegible]
10 Oct '78

WCC, TTC B2S, Phase II
VOL IIA

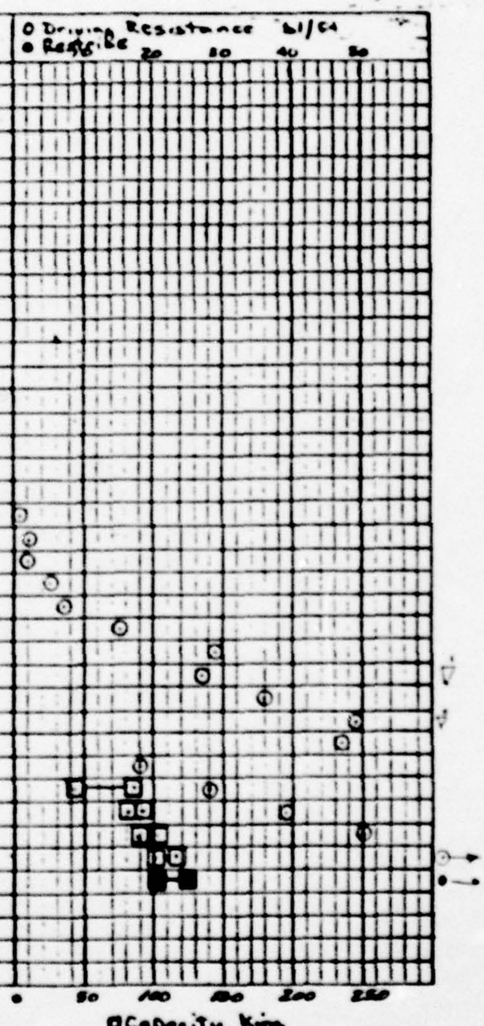
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 05 160 I 3800

Pile Type	Drafus Fill (Truck)	Hammer	Vulcan V1	Date	11/2/78
Pile length	42'	Energy	15,000 ft lbs	Time	0840 to 1015
Ground el.	Trench level	Operating Rate	60 blows/min	Inspector	Bob [illegible]

Depth ft	Blows	Remarks
0-1		
2		[illegible] jetted to 24' depth
3		pile [illegible] to 19' depth
4		
5		
6		
7		
8		
9		
10		[illegible] in relation water
11		at 10'
12		[illegible] in relation [illegible]
13		[illegible] like [illegible]
14		([illegible])
15		
16		
17		
18		
19		
20	1	
21	2	
22	2	
23	5	
24	7	
25	15	
26	29	
27	27	
28	36	
29	49	
30	47	
31	18	Analyzer
32	28	
33	39	
34	56	
35	5 for 8"	
	41 for 6"	Restrike on 11/3/78 at
		19 25 hrs



Dynamic Measurements YES

Sequence No.	Depth ft
01 (PDP)	30 - 34.75
02 (Restrike)	34.75 - 35.25

Notes:
Pile batter at E.O.D.
1.7% S
2.7% E

■ Restrike
▽ Jetting

WCC, 77C 825, Phase II, Vol II A

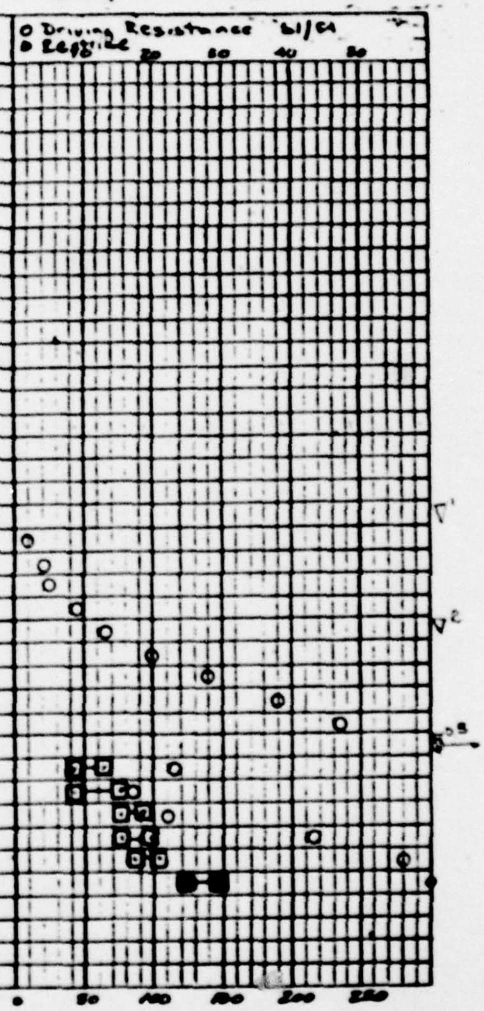
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

P. 1 of 1

ID No. 03 05 160 I 8700

Pile Type Douglas fir   Hammer Vulcan V1   Date 11/2/78
Pile length 42'   Energy 15,000 ft-lbs   Time 10:25 - 11:36
Ground el. trench level   Operating Rate 60 bl/min   Inspector - Green

Depth ft	Blows	Remarks
0-1		10:44 start jetting
2		to 30'
3		
4		
5		
6		
7		
8		
9		
10		
11		Lignite and graphite
12		material comes up
13		with jet
14		
15		
16		
17		
18		
19		
20		
21	2	11:26
22	4	
23	5	
24	9	
25	13	
26	20	
27	28	
28	38	
29	47	
30	76	
31	23	
32	17	
33	22	
34	43	
35	42/9"	11:31
	30/6"	restrike 11/2/78



Dynamic measurements yes

Sequence No.	Depth ft
01 (PDA)	30'-34'9"
02 restrike (PDA)	34'9"-36'3"

□ Capacity, kips
■ Restrike
∇ Jetting depth

Notes:
Pile batter at E.O.D.
1.1% S
2.7% E

WCC, YTC 835, Phase II
Vol. II A

O-2 SUMMARY LOG OF DATA ACQUIRED DURING

PRELOADING, MONOLITH M5

ID No.: 07-05-

MONOLITH(S) TESTED: M5

TEST TYPE: PRELOADING

	Sequence No.	0000	0001	0002	0003	0004
	Date/Time	2/13/79 0700	2/14 0030	2/14 0120	2/14 0345	2/14 0730
	Description of Event	INITIALIZATION	V = 80t H = 0	V = 160t H = 0	V = 240t H = 0	V = 240t H = 24t
PRIMARY DATA	Dial Gages, P(1)	✓			✓	✓
	Optical Horizontal Control, P(1)	✓			✓	✓
	Optical Vertical Control, P(1)	✓			✓	✓
	Tape Extensometer, P(1)	ref beams only			ref beams only	ref beams only
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓ except No. 44				✓ except No. 44
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	✓
	Surface Settlement, S(11)	✓				
	Ground Inclinometers, S(12)	✓				
	Sondex, S(12)	✓				
	Piezometers, S(13)	✓			✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	✓
	Strain Gages, S(10)	✓	✓	✓	✓	✓
	Record No. – 02	BALANCE	5	6	7	8
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C825
Phase IV, Vol III A

ID No.: 07-05-

MONOLITH(S) TESTED: MS

TEST TYPE: PRELOADING

	Sequence No.	0006	0007	0011	0021	0035
	Date/Time	2/14 0730	2/14 1745	2/15 0000	2/15 1000	2/15 2100
	Description of Event	V = 240t H = 48t = H_1	V = 240t H = H_1/10	V = 240t H = H_1 N = 5	V = 240t H = H_1 N = 15	V = 240t H = H_1 N = 28
PRIMARY DATA	Dial Gages, P(1)	✓		✓	✓	
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	ref beams only		ref beams only	ref beams only	
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓ except No. 44		✓ except No. 44	✓ except No. 49	
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓		✓	✓	
	Surface Settlement, S(11)	✓			✓	
	Ground Inclinometers, S(12)	✓				
	Sondex, S(12)					
	Piezometers, S(13)	✓		✓	✓	
	Thermo-couples, S(14)	✓		✓	✓	
	Strain Gages, S(10)	✓	✓	✓		✓
	Record No. – 02	9, 10	11	12		14
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C825
Phase IV, Vol III A

ID No.: 07-05 -

MONOLITH(S) TESTED: M5

TEST TYPE: PRELOADING

	Sequence No.	0047	0049			
	Date/Time	2/16 0800	2/16 1600			
	Description of Event	V = 240t H = H_1 N = 40	V = 0 H = 0			
PRIMARY DATA	Dial Gages, P(1)	✓	✓			
	Optical Horizontal Control, P(1)	✓	✓			
	Optical Vertical Control, P(1)	✓	partial			
	Tape Extensometer, P(1)	ref beams only	ref beams only			
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓ except No. 44				
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓			
	Surface Settlement, S(11)	✓				
	Ground Inclinometers, S(12)	✓				
	Sondex, S(12)	✓				
	Piezometers, S(13)	✓	✓			
	Thermo-couples, S(14)	✓				
	Strain Gages, S(10)	✓	✓			
	Record No. – 02	15	18			
	Record No. – 03					

Note: ✓ = Complete set of readings taken

O.3 SUMMARY LOG OF DATA ACQUIRED DURING PILE DRIVING, MONOLITH M5

ID No.: 09-05-

MONOLITH(S) TESTED: M5

TEST TYPE: PDET

	Sequence No.	0000	0001	0002	0102	0104
	Date/Time	2/16/79 1900	2/17 0115	2/17 0800	2/17 1130	2/17 1845
	Description of Event	INITIALIZATION	FULL AXIAL AND LATERAL LOADS	FULL AXIAL AND LATERAL LOADS	PILE NO 1 ~ 50ft HALF PENETRATION	PILE NO. 1 ~ 100ft FULL PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	✓		✓	✓	✓
	Optical Vertical Control, P(1)	✓		✓	✓	✓
	Tape Extensometer, P(1)	✓		✓	✓	ref beams only
	Tilt Meters, P(1)	✓		✓	✓	✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)		✓			
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓		✓	✓	✓
	Surface Settlement, S(11)	✓			✓	✓
	Ground Inclinometers, S(12)		✓			
	Sondex, S(12)					
	Piezometers, S(13)	✓		✓	✓	✓
	Thermo-couples, S(14)	✓		✓	✓	✓
	Strain Gages, S(10)	✓	✓	✓		✓
	Record No. – 02	BALANCE	5	6		7
	Record No. – 03					

Note: ✓ = Complete set of readings taken

ID No.: 09-05-

MONOLITH(S) TESTED: M5

TEST TYPE: PDET

	Sequence No.	0202	0204	0300	0303	0306
	Date/Time	2/17 2330	2/18 0250	2/19 0800	2/19 1740	2/19 2300
	Description of Event	PILE NO. 2 ~52ft HALF PENETRATION	PILE NO. 2 ~96ft FULL PENETRATION	PILE NO. 3 START	PILE NO. 3 ~51ft HALF PENETRATION	PILE NO. 3 ~95ft FULL PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓		✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓		✓	✓	✓
	Tape Extensometer, P(1)	ref beams only	ref beams only	ref beams only	✓	✓
	Tilt Meters, P(1)	✓	✓	✓	✓	✓
SECONDARY DATA	Timber Pile Inclinometers, S(9)					✓
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	✓
	Surface Settlement, S(11)	✓	✓	✓	✓	✓
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	✓
	Strain Gages, S(10)	✓	✓		✓	✓
	Record No. – 02	8	9, 10		11	12
	Record No. – 03					

Note: ✓ = Complete set of readings taken

YTC 825
Phase IV, Vol III A

ID No.: 09-05-

MONOLITH(S) TESTED: M5

TEST TYPE: PDET

	Sequence No.	0402	0402	0405	0503	0506
	Date/Time	2/20 0230	2/20 0715	2/20 1130	2/20 1630	2/21 0135
	Description of Event	PILE NO. 4 ~56 ft HALF PENETRATION	PILE NO. 4 ~56 ft HALF PENETRATION	PILE NO. 4 ~95 ft FULL PENETRATION	PILE NO. 5 ~50 ft HALF PENETRATION	PILE NO. 5 ~95 ft FULL PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓	✓	ref beams only	✓
	Tilt Meters, P(1)	✓			✓	
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)		✓	✓	✓	✓
	Surface Settlement, S(11)	✓			✓	✓
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)		✓	✓	✓	✓
	Thermo-couples, S(14)		✓	✓	✓	✓
	Strain Gages, S(10)	✓			✓	✓
	Record No. – 02	13			14	15
	Record No. – 03					

Note: ✓ = Complete set of readings taken

ID No.: 09-05-

MONOLITH(S) TESTED: M5 TEST TYPE: PDET

		0600	0603	0606	0703	0706
	Sequence No.	0600	0603	0606	0703	0706
	Date/Time	2/21 0730	2/21 1130	2/21 1500	2/21 1820	2/21 2300
	Description of Event	PILE NO. 6 START	PILE NO. 6 ~50ft HALF PENETRATION	PILE NO. 6 ~95ft FULL PENETRATION	PILE NO. 7 ~52ft HALF PENETRATION	PILE NO. 7 ~95ft FULL PENETRATION
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓	ref beams only	ref beams only	ref beams only
	Tilt Meters, P(1)	✓	✓			
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓				✓
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	✓
	Surface Settlement, S(11)	✓	✓	✓	✓	✓
	Ground Inclinometers, S(12)					✓
	Sondex, S(12)					✓
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	✓
	Strain Gages, S(10)	✓		✓	✓	✓
	Record No. – 02	16		17	18	19,20,21
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C885
Phase IV, Vol III f

ID No.: 09-05-

MONOLITH(S) TESTED: M5

TEST TYPE: PDET

	Sequence No.	0706				
	Date/Time	2/22 0800				
	Description of Event	NO LOADS				
PRIMARY DATA	Dial Gages, P(1)	✓				
	Optical Horizontal Control, P(1)	✓				
	Optical Vertical Control, P(1)	✓				
	Tape Extensometer, P(1)	ref beams only				
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)	✓				
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓				
	Surface Settlement, S(11)	✓				
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓				
	Thermo-couples, S(14)	✓				
	Strain Gages, S(10)					
	Record No. – 02					
	Record No. – 03					

Note: ✓ = Complete set of readings taken

0.4 SUMMAR[illegible] LOG OF [illegible]

AX[illegible] [illegible]

ID No.: 10-05-

MONOLITH(S) TESTED: M5

TEST TYPE: AXIAL LOAD TEST

	Sequence No.	0000	0000	0002	0003	0004
	Date/Time	2/22/79 2000	2/23 1050	2/23 1600	2/23 2015	2/24 0430
	Description of Event	INITIALIZATION	INITIALIZATION	V=240t H=0	V=400t H=0	V=560t H=0
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)	✓	✓	✓	✓	✓
	Tilt Meters, P(1)	✓				
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	✓
	Surface Settlement, S(11)	✓	✓	✓	✓	✓
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)	✓	✓	✓	✓	✓
	Strain Gages, S(10)	✓	✓	✓	✓	✓
	Record No. – 02	BALANCE	4	6, 7, 8	9, 10, 11	12, 13
	Record No. – 03					

Note: ✓ = Complete set of readings taken

ID No.: 10-05-

MONOLITH(S) TESTED: M5

TEST TYPE: AXIAL LOAD TEST

	Sequence No.	0005	0006	0008	0008	0008
	Date/Time	2/24 1600	2/24 2101	2/24 2253	2/24 2350	2/25 0030
	Description of Event	V = 720t H = 0	V = 760t H = 0	V = 560t H = 0	V = 267t H = 0	V = 0 H = 0
PRIMARY DATA	Dial Gages, P(1)	✓				
	Optical Horizontal Control, P(1)	✓				
	Optical Vertical Control, P(1)	✓				
	Tape Extensometer, P(1)	✓				
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	
	Surface Settlement, S(11)	✓				
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓				
	Thermo-couples, S(14)	✓		✓	✓	✓
	Strain Gages, S(10)	✓	✓	✓	✓	✓
	Record No. – 02	14, 15	16	18	19	20
	Record No. – 03					

Note: ✓ = Complete set of readings taken

[illegible]
Phase [illegible], [illegible] A

ID No.: 10 - 05 -

MONOLITH(S) TESTED: M5

TEST TYPE: AXIAL LOAD TEST

	Sequence No.	0008				
	Date/Time	2/26 0820				
	Description of Event					
PRIMARY DATA	Dial Gages, P(1)	E only				
	Optical Horizontal Control, P(1)	monolith only				
	Optical Vertical Control, P(1)	✓				
	Tape Extensometer, P(1)	✓				
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)					
	Surface Settlement, S(11)	✓				
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)					
	Thermo-couples, S(14)					
	Strain Gages, S(10)					
	Record No. – 02					
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C-825
Phase IV; Vol III A

0.5 COMPLETE DRIVING RECORDS OF PROTOTYPE PILES DRIVEN WITH IMPACT HAMMER, MONOLITH M5

The driving records are presented in chronological order of driving for prototype piles No. 1 through 7, driven with a VULCAN 010 hammer.

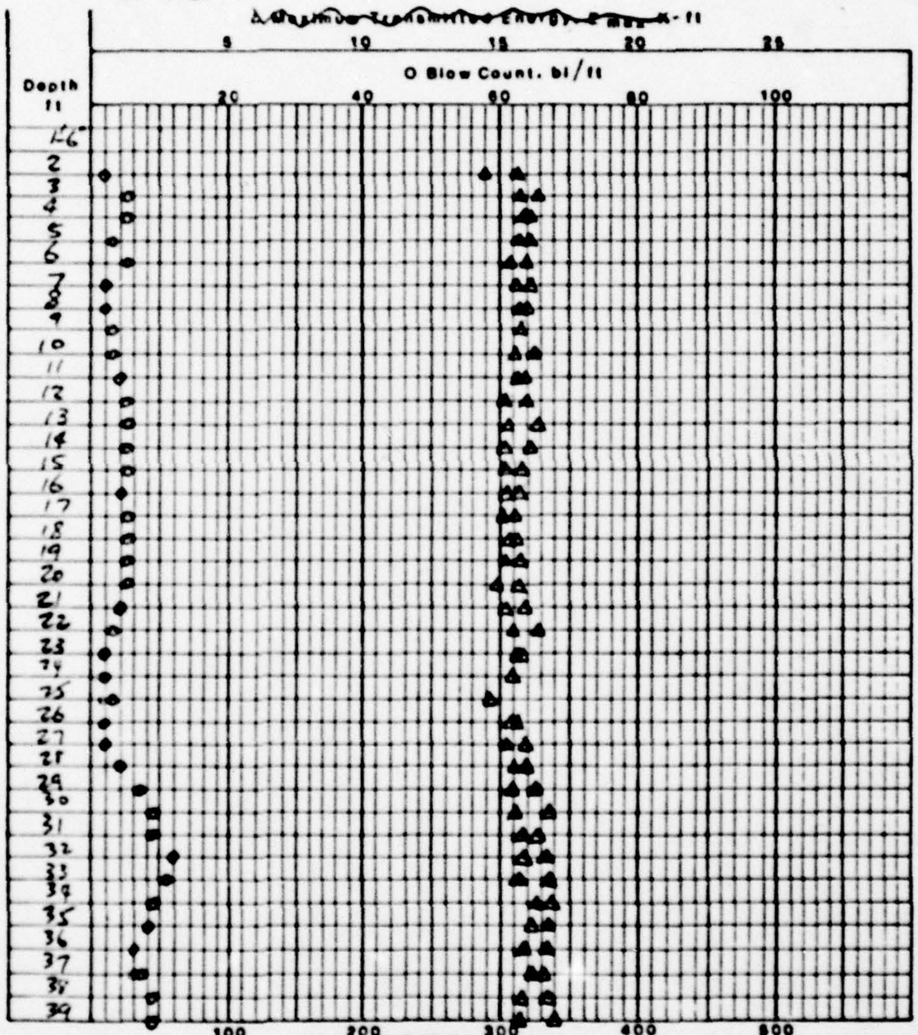
NOTE: No reasonable Energy data thruout, good Force data up to 47' only.

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 3
I.D. No. 09 05 180 0 0100
Date 17 Feb 79
Operator JSL

PILE DRIVING MEASUREMENTS
PILE NO. 01
40' M5

	Time	Sequence No.
First		
Finish		



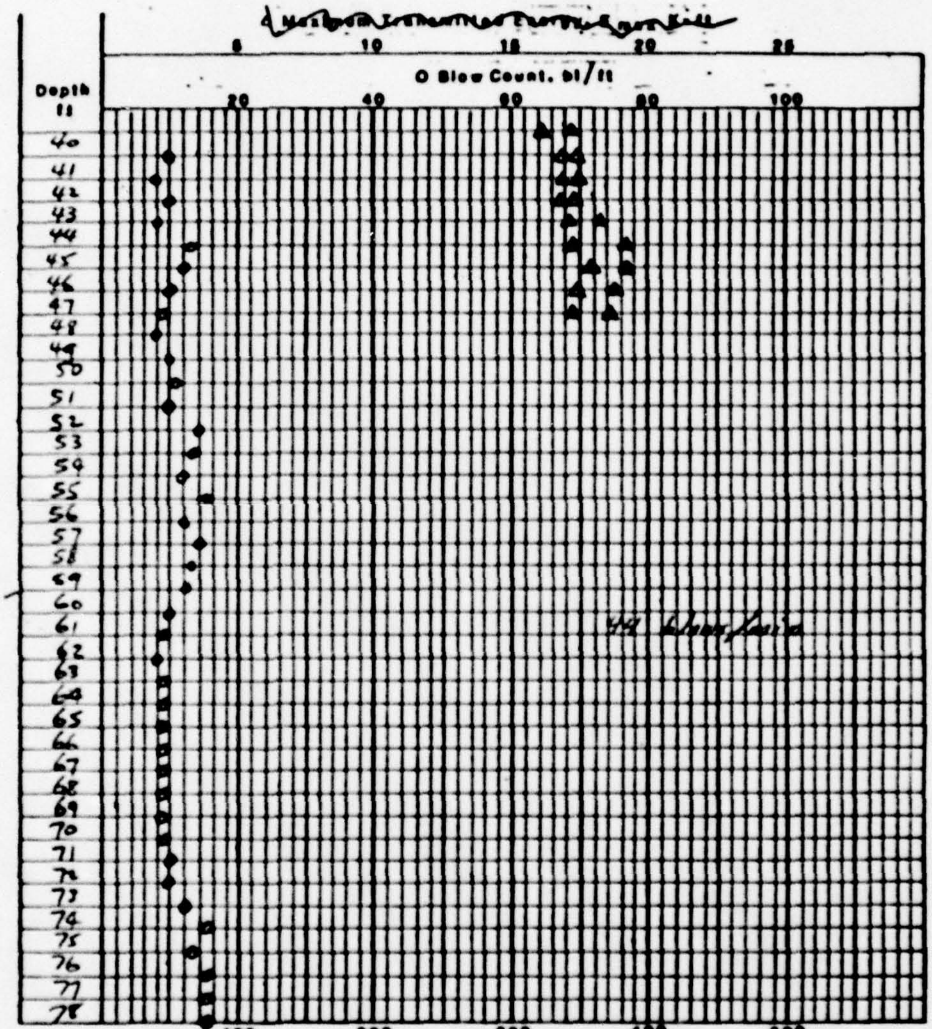
WCC. Y7C825. Phase IV; Vol. II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 3
I.D. No. 09 05 180 0 0100
Date 17 Feb 79
Operator JSL

PILE DRIVING MEASUREMENTS
PILE NO. 01

	Time	Sequence No.
First		
Finish		



▲: Maximum Driving Force, F_{max}, Kips

WCC. 77C026. Phase III, Vol. II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 3 of 3

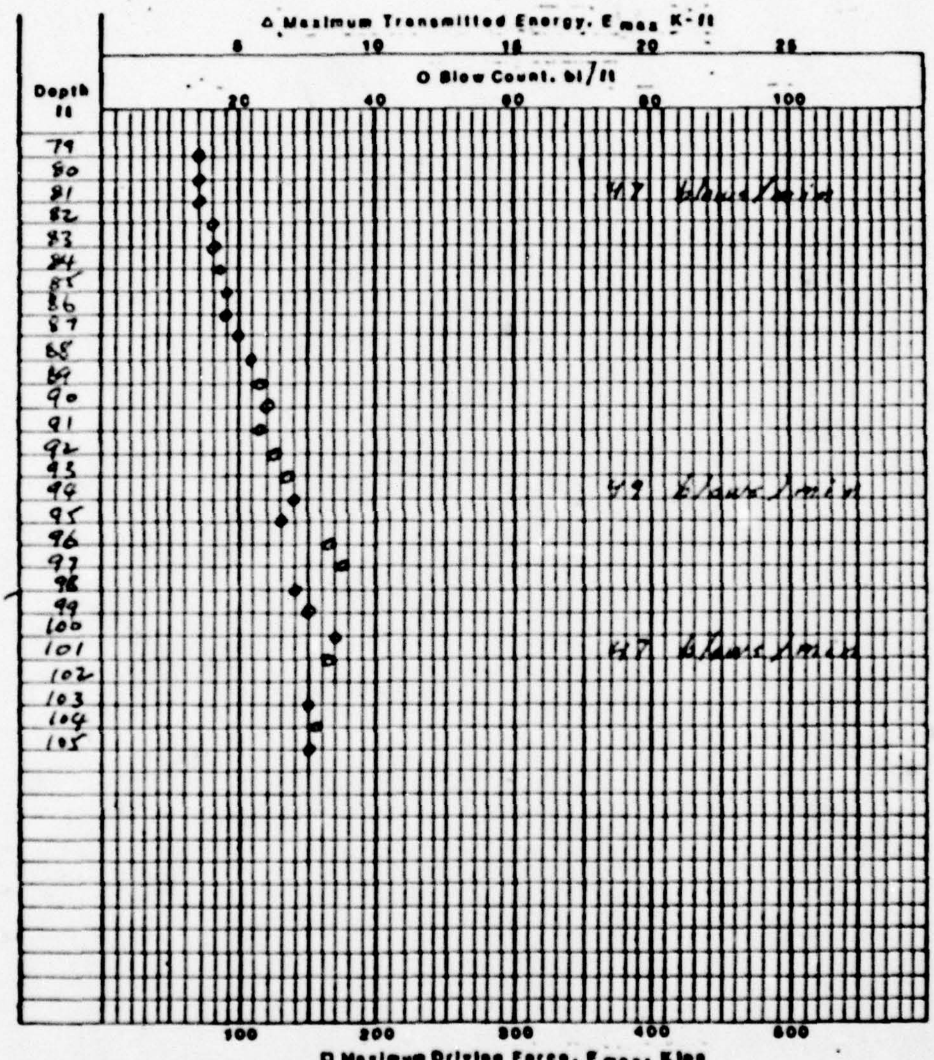
I.D. No. 09 05 180 0010

Date 17 Feb 7

Operator JSL

PILE DRIVING MEASUREMENTS
PILE NO. 01

	Time	Sequence No.
First		
Finish		



WCC. 77C026. Phase III ; Vol. III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 20
PILE DRIVING EFFECTS TEST

P. 1 of 3

I.D. No. 0905 180 0 0200

Date 17 Feb 79

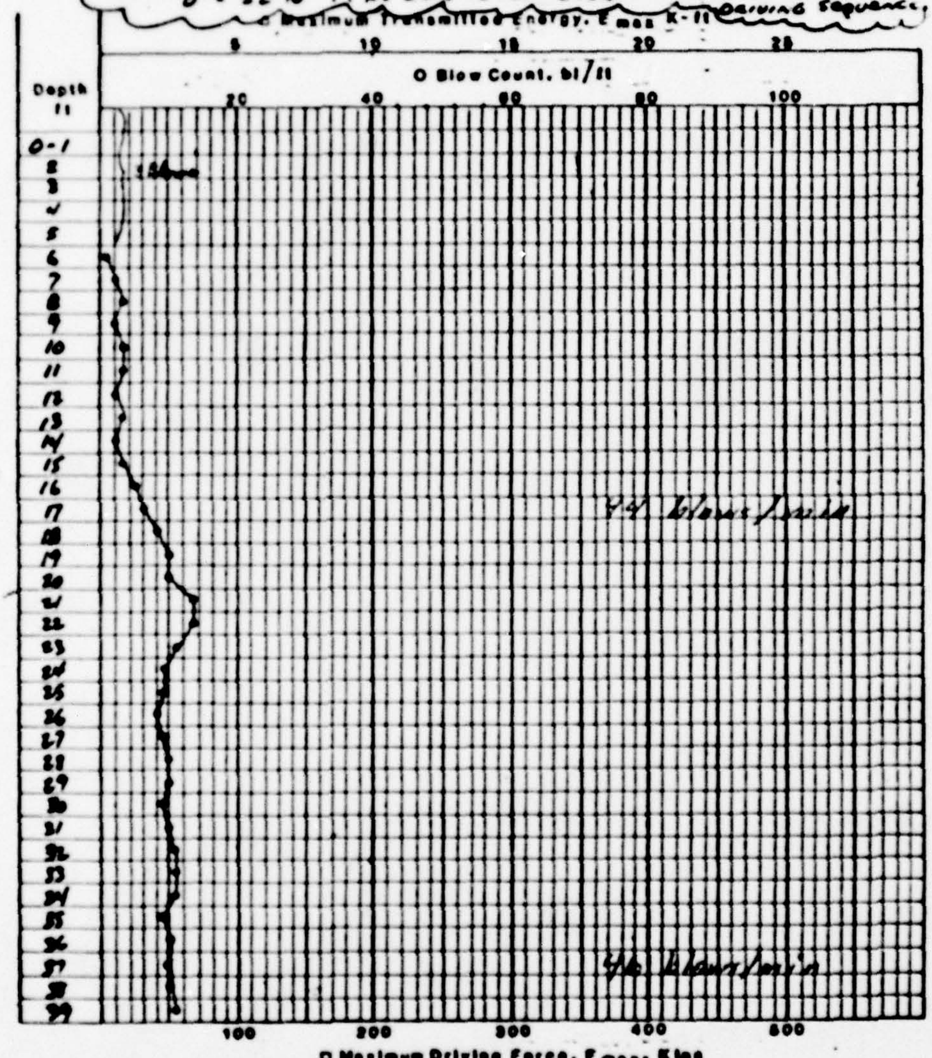
Operator TRW

PILE DRIVING MEASUREMENTS

PILE NO. 02

	Time	Sequence No. 0201
First	22:26	0201
Finish	02:39	0204

NOTE: ANALYZER NOT WORKING FROM 0' - 52'10" ∴ NO DATA TO PLOT EXCEPT BLOW COUNTS FOR THE DRIVING SEQUENCE.



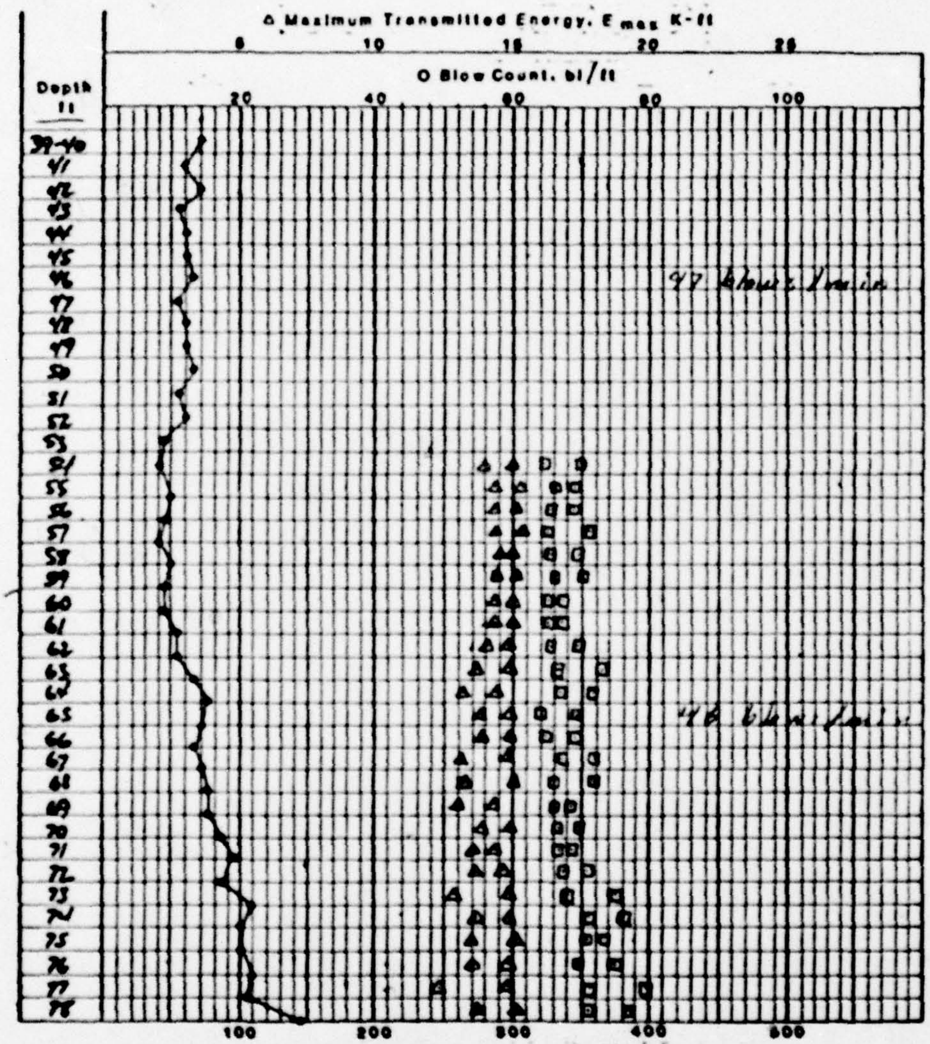
WCC. Y7C026. Phase III, VOL. III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 3
I.D. No. 09 05 180 0 0200
Date 17 Feb 79
Operator JBW

PILE DRIVING MEASUREMENTS
PILE NO. 02

	Time	Sequence No.
First	22:56	0201
Finish	02:39	0204



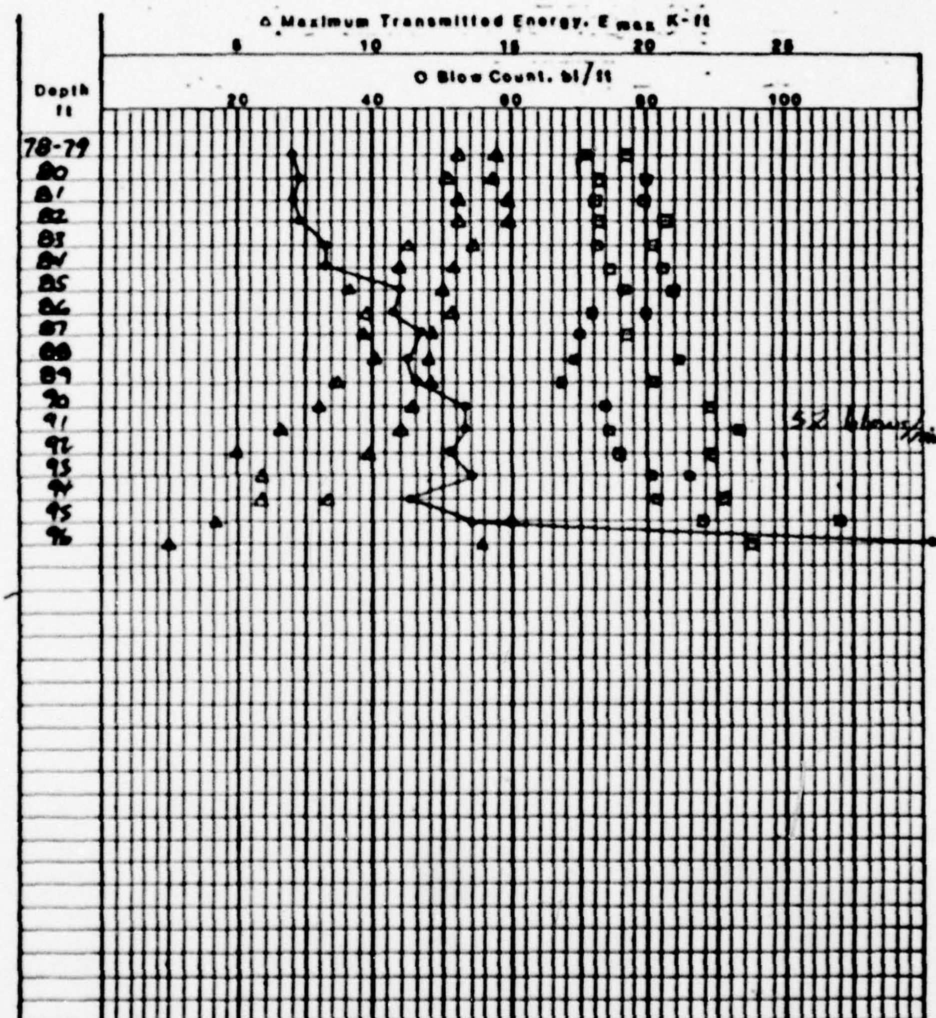
WCC. Y7C825. Phase III, VOL II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 3 of 3
I.D. No. 09 05 180 0 0200
Date 17Feb79
Operator JBH

PILE DRIVING MEASUREMENTS
PILE NO. 02

	Time	Sequence No.
First	22:36	0201
Finish	02:39	0204



WCC. Y7C826. Phase III, Vol. III A

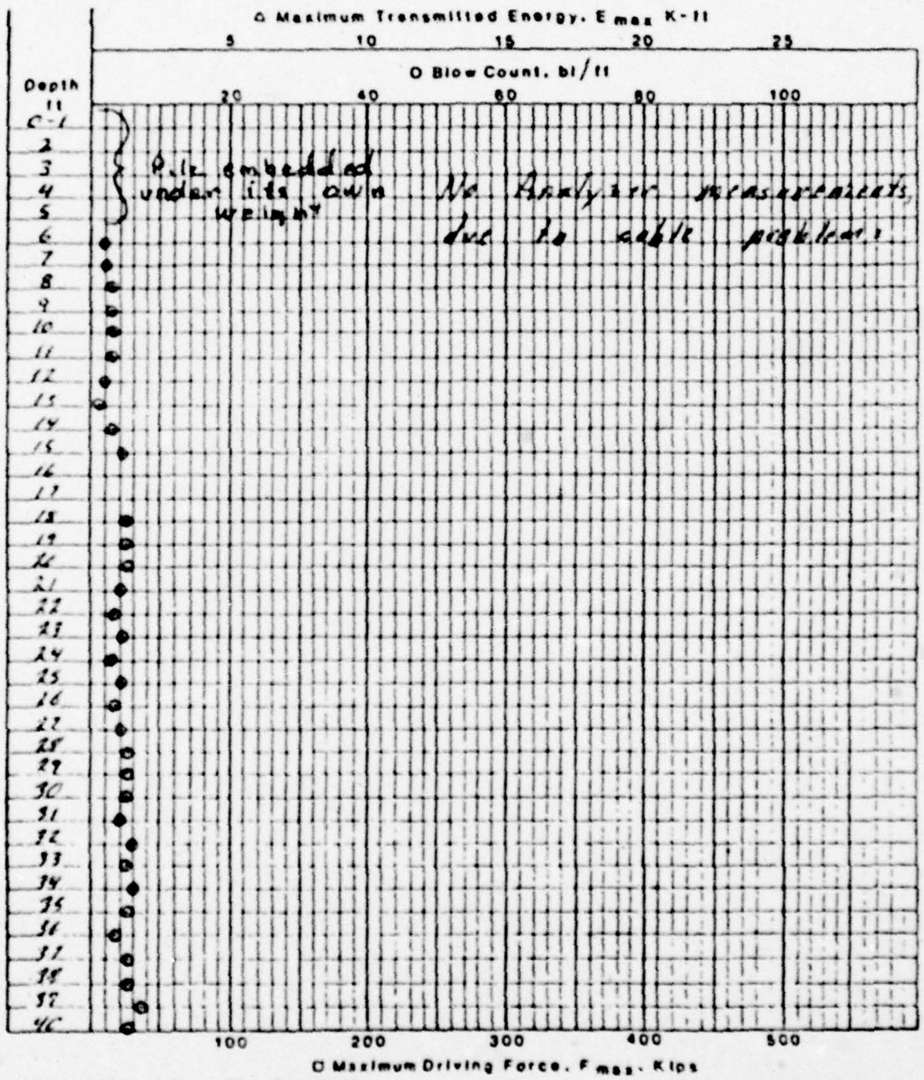
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 3
I.D. No. 09/05/180/0/03..
Date 2/..
Operator ...

PILE DRIVING MEASUREMENTS

PILE NO. 07

	Time	Sequence No.
First		
Finish		



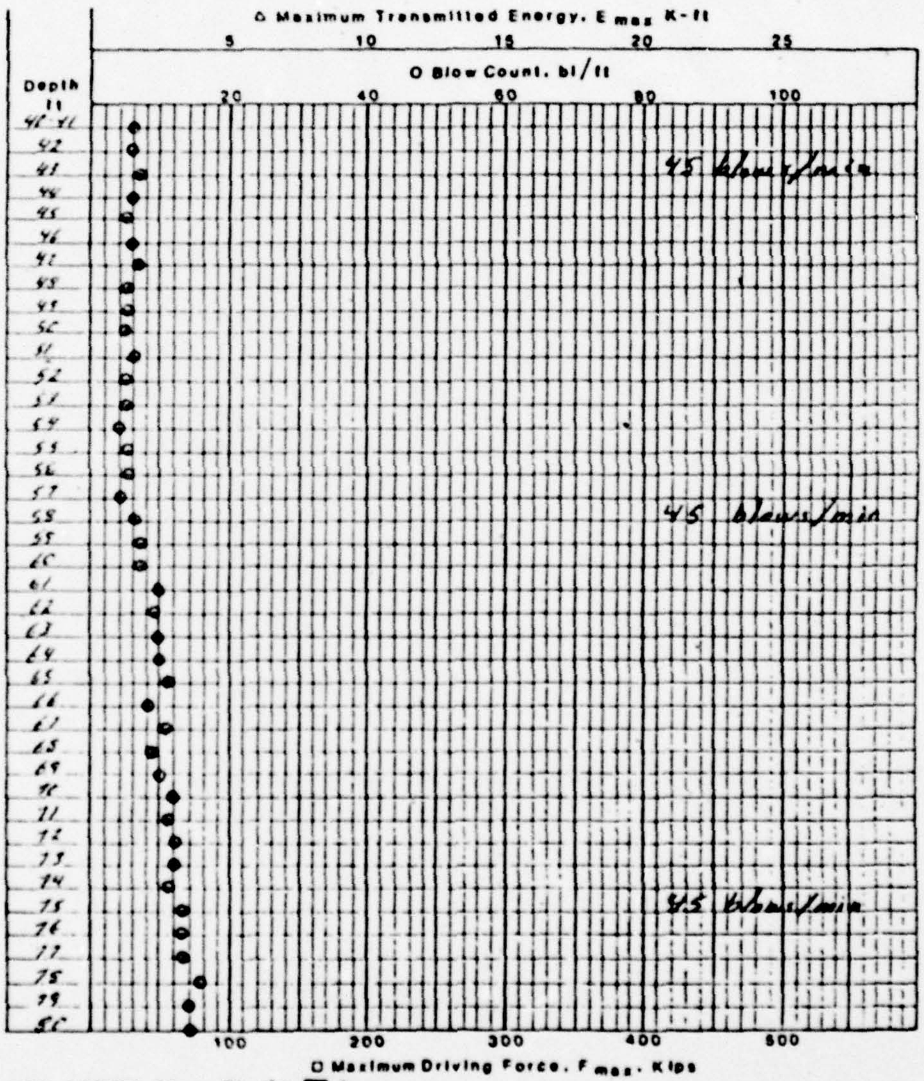
WCC. Y7C825. Phase II ; Vol. III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 3
I.D. No. 09/05/ 180/ 0/ 0300
Date 2/19/7-
Operator ECH

PILE DRIVING MEASUREMENTS
PILE NO. 03

	Time	Sequence No.
First		
Finish		



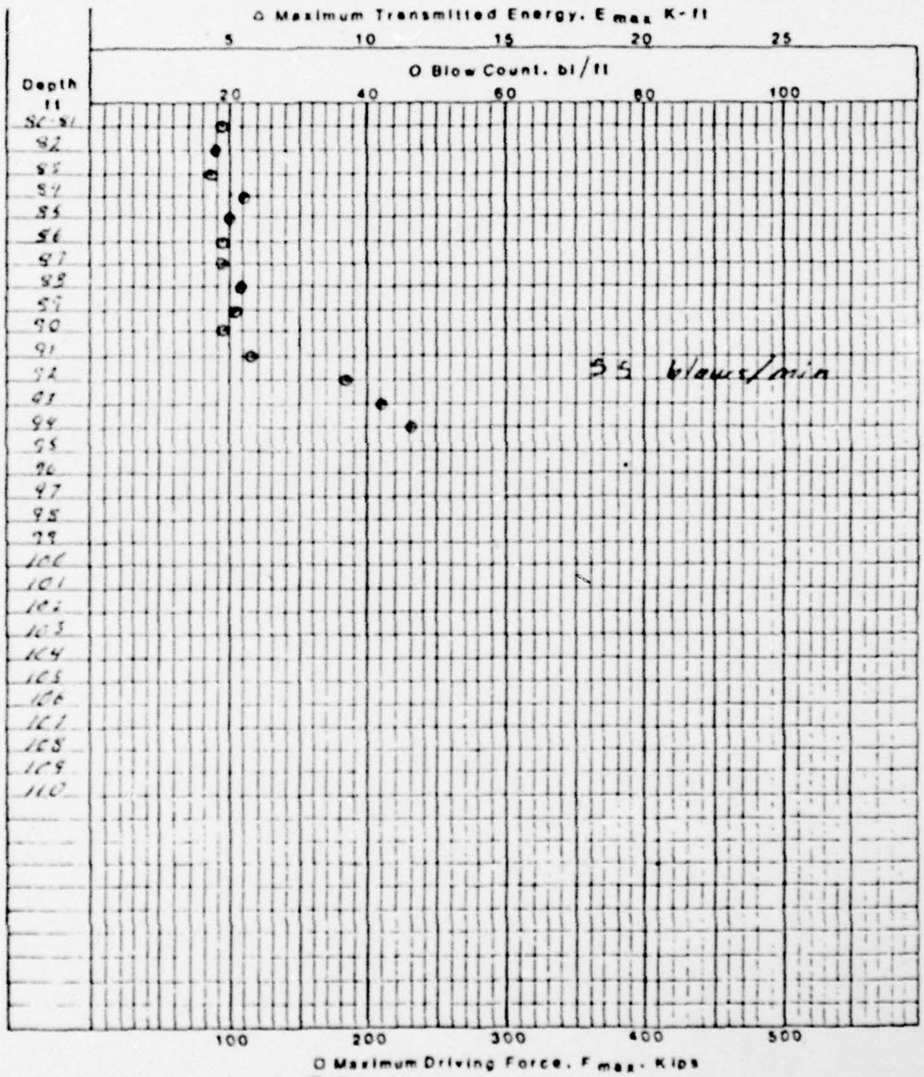
WCC. Y7C825. Phase IV; Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 3 of 3
I.D. No. 09/05/1180/10/1030
Date 2/17/
Operator CCH

PILE DRIVING MEASUREMENTS
PILE NO. 03

	Time	Sequence No.
First		
Finish		



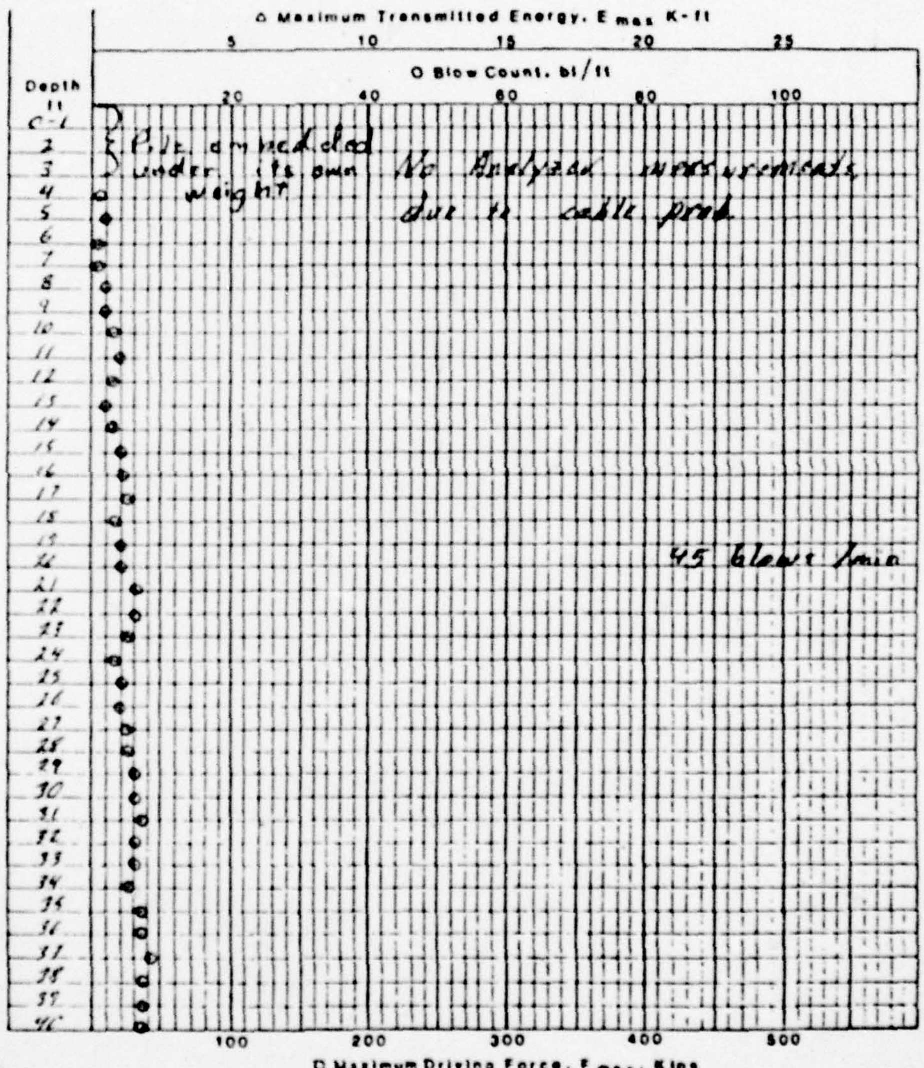
WCC, Y7C825, Phase IV; KL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 1
I.D. No. 09/05/1801/1/0400
Date 2/20/7
Operator Az

PILE DRIVING MEASUREMENTS
PILE NO. 04

	Time	Sequence No.
First		
Finish		



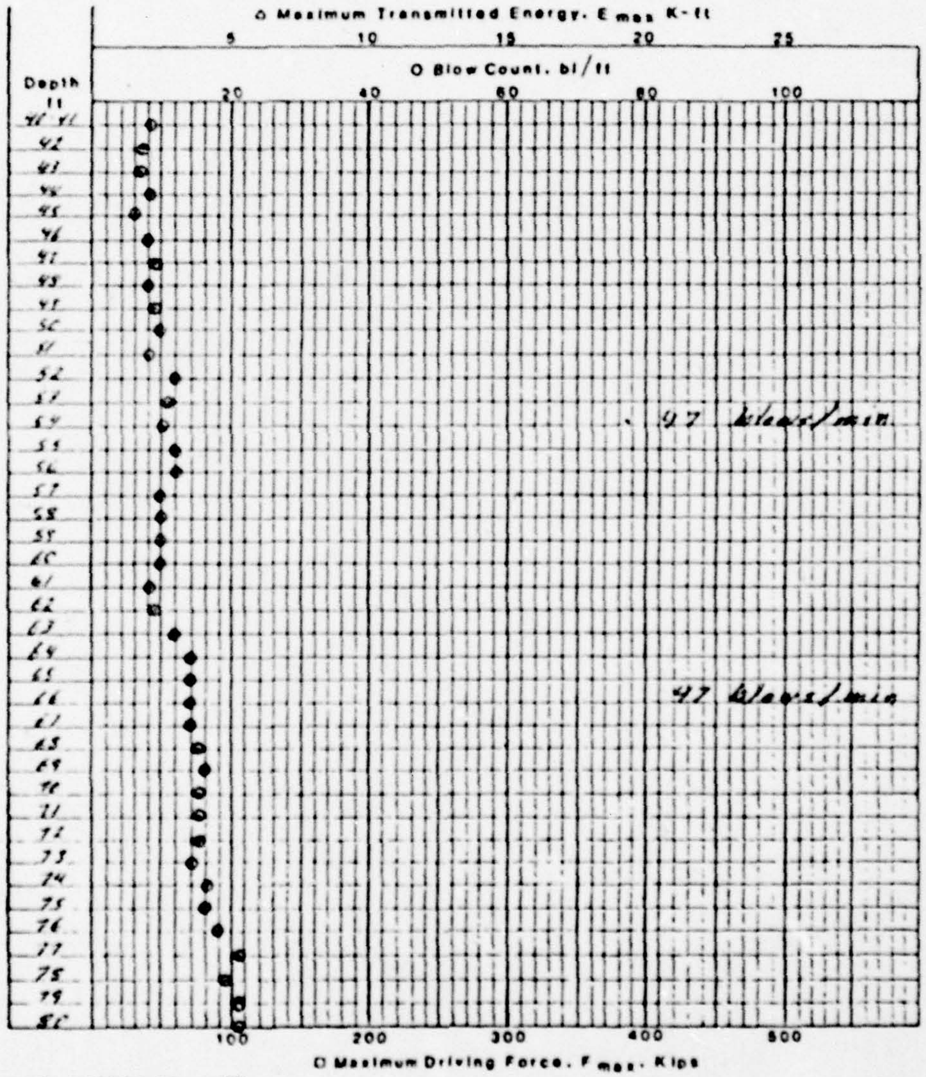
WCC, Y7C825, Phase II ; Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

p. 2 of 3
I.D. No. 09/05/ 180 11/0400
Date 2/20/
Operator AP

PILE DRIVING MEASUREMENTS
PILE NO. 04

	Time	Sequence No.
First		
Finish		



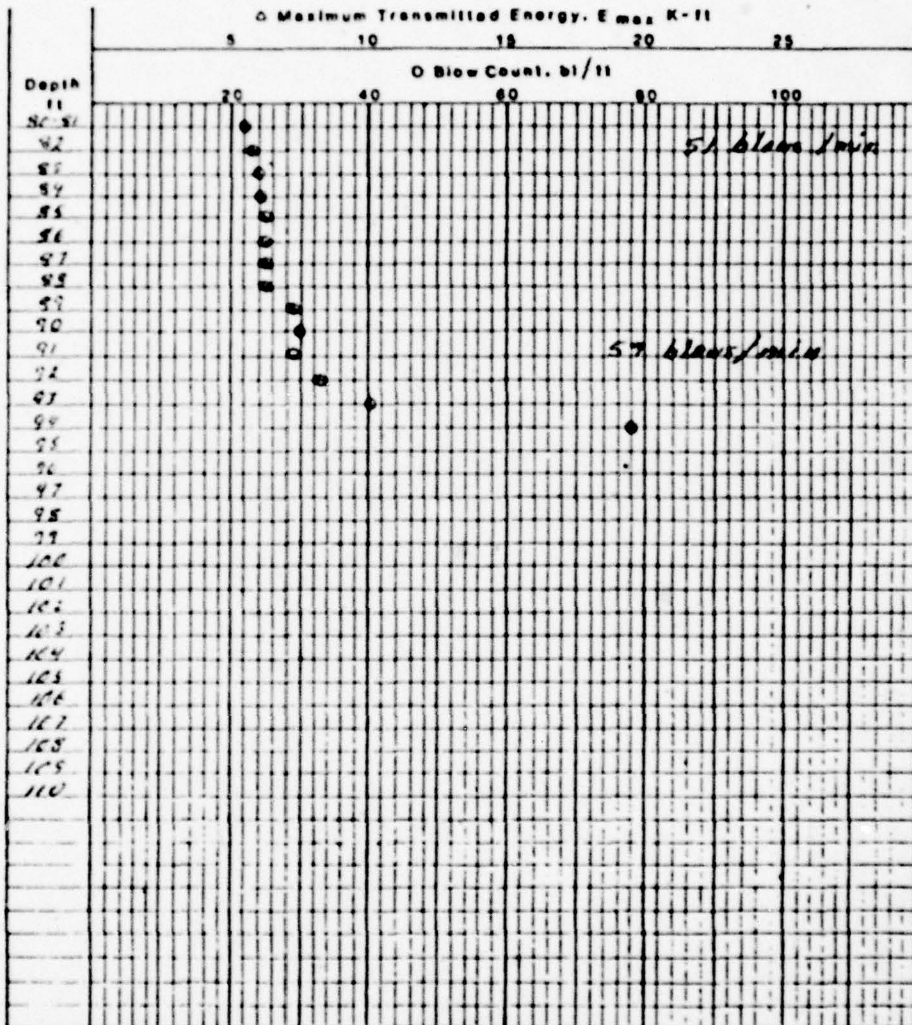
WCC, Y7C825, Phase IV
Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 3 of 3
I.D. No. 02/05/ 1801 1/0400
Date 2/21/79
Operator AT

PILE DRIVING MEASUREMENTS
PILE NO. 04

	Time	Sequence No.
First		
Finish		



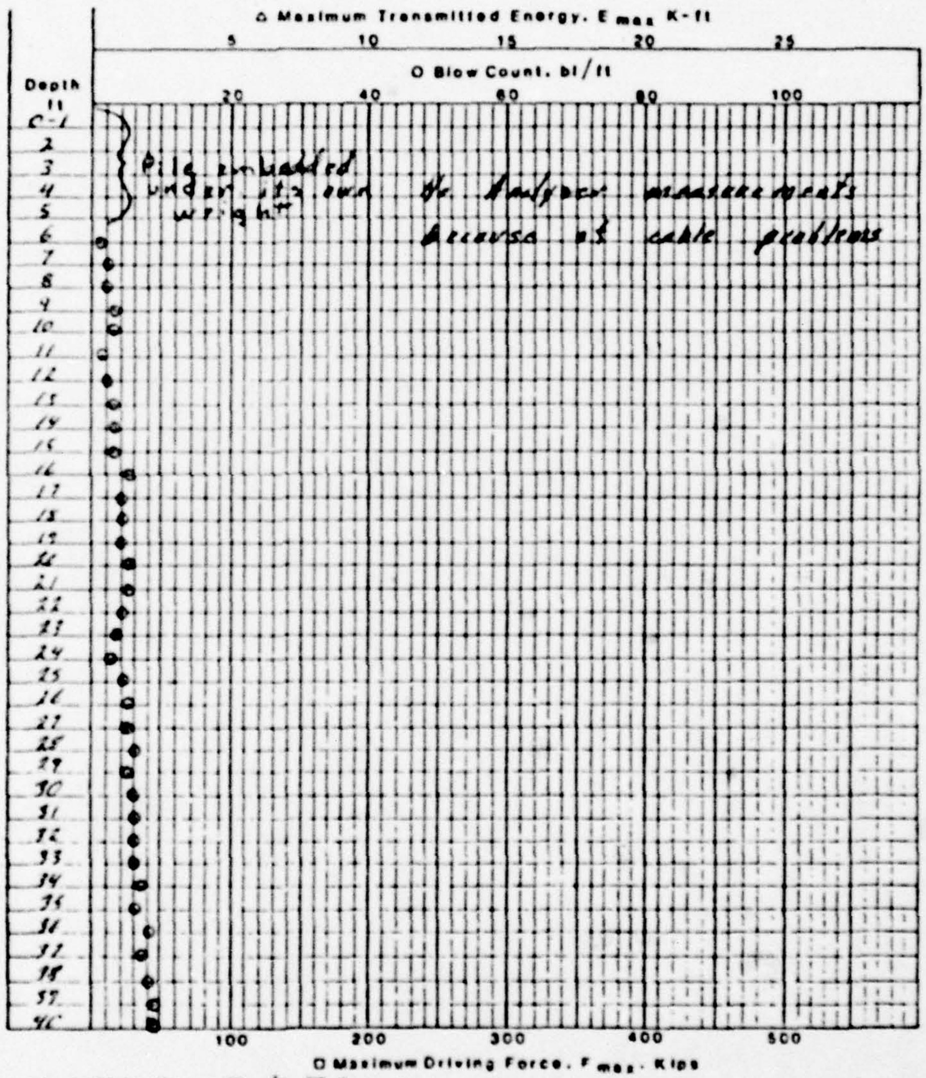
WCC. Y7C825. Phase IV, VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 3
I.D. No. 09/05/18/0/0500
Date 2/2/...
Operator ECH

PILE DRIVING MEASUREMENTS
PILE NO. 05

	Time	Sequence No.
First		
Finish		



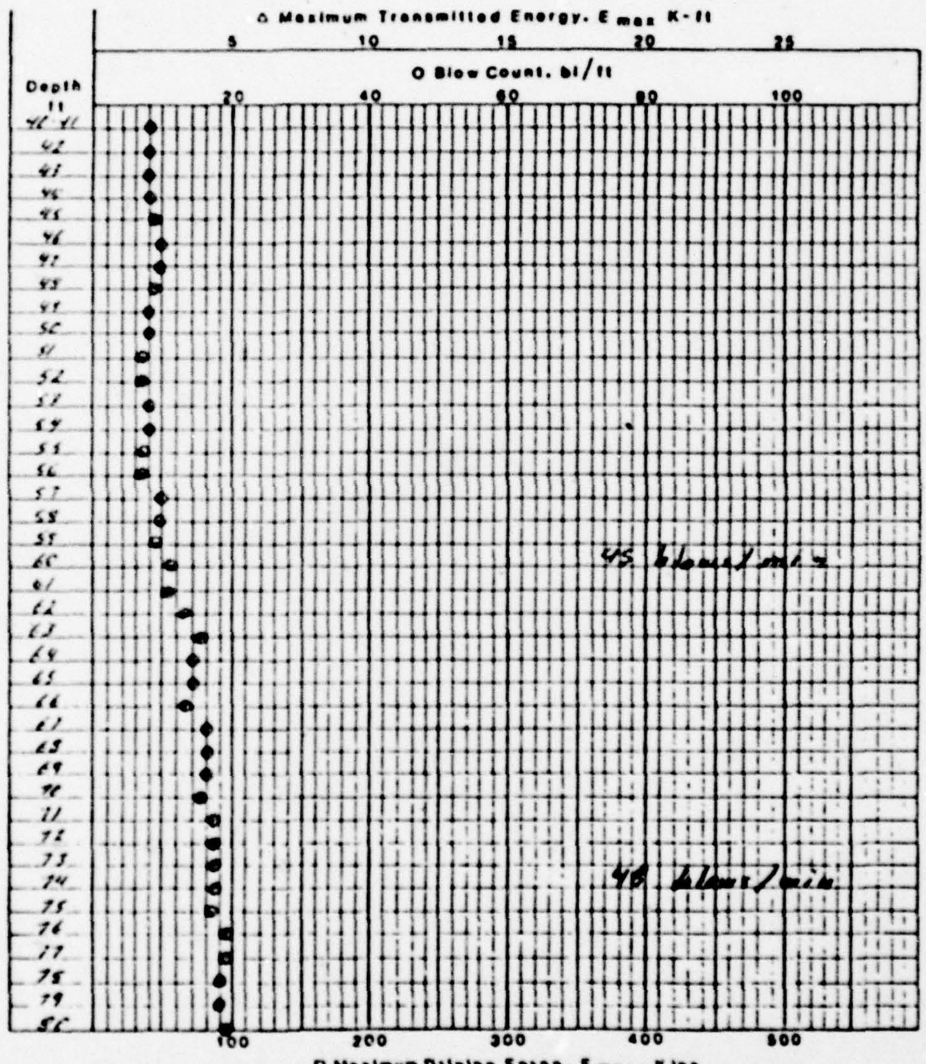
WCC, Y7C825, Phase IV; Vol III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 3
I.D. No. 09/05/ 160/ 0 /050C
Date 2/2/1?
Operator AZ

PILE DRIVING MEASUREMENTS
PILE NO. 05

	Time	Sequence No.
First		
Finish		



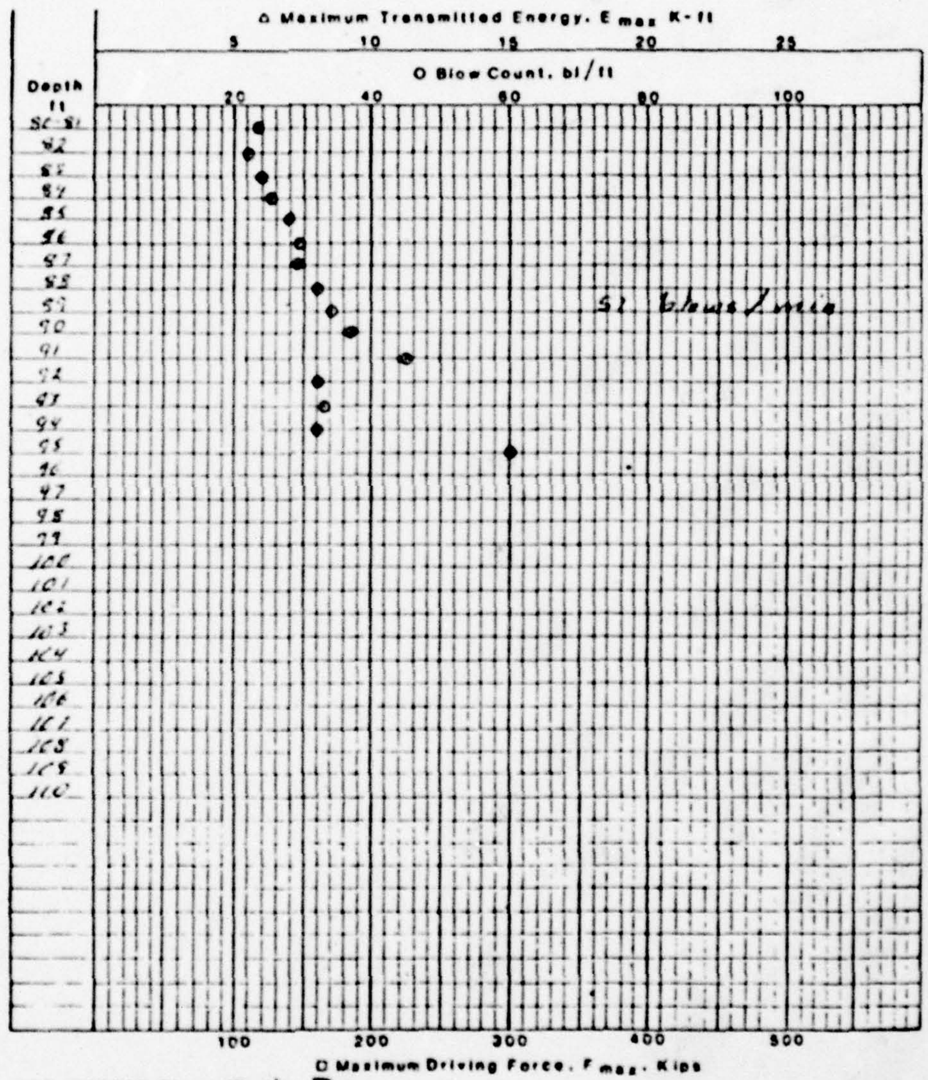
WCC. Y7C825. Phase II; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

p. 3 of 3
I.D. No. 09/05/ 180/ 0/0530
Date 2/21/7?
Operator RT

PILE DRIVING MEASUREMENTS
PILE NO. 05

	Time	Sequence No.
First		
Finish		



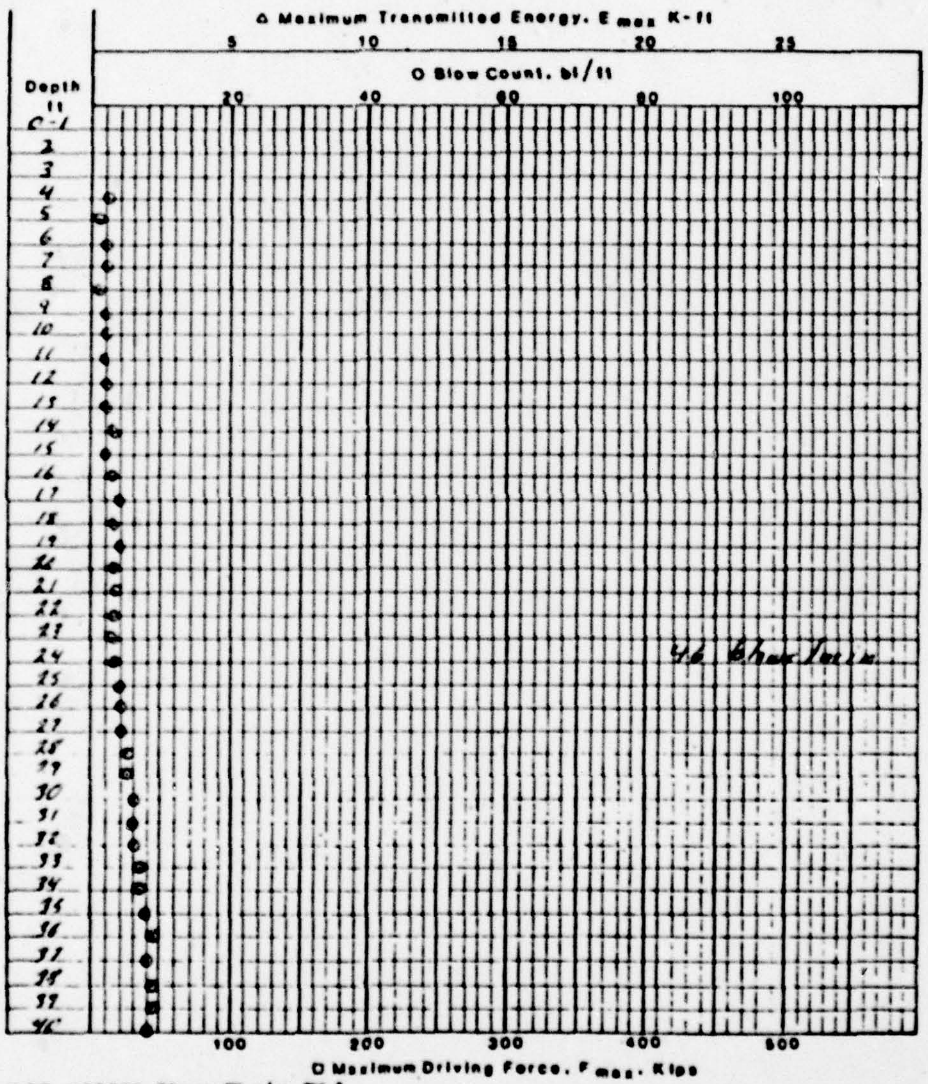
WCC. Y7C825. Phase IV ; Vol. III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 3
I.D. No. 09/05/1801/1/0600
Date 2/21/79
Operator DA

PILE DRIVING MEASUREMENTS
PILE NO. 01

	Time	Sequence No.
First		
Finish		



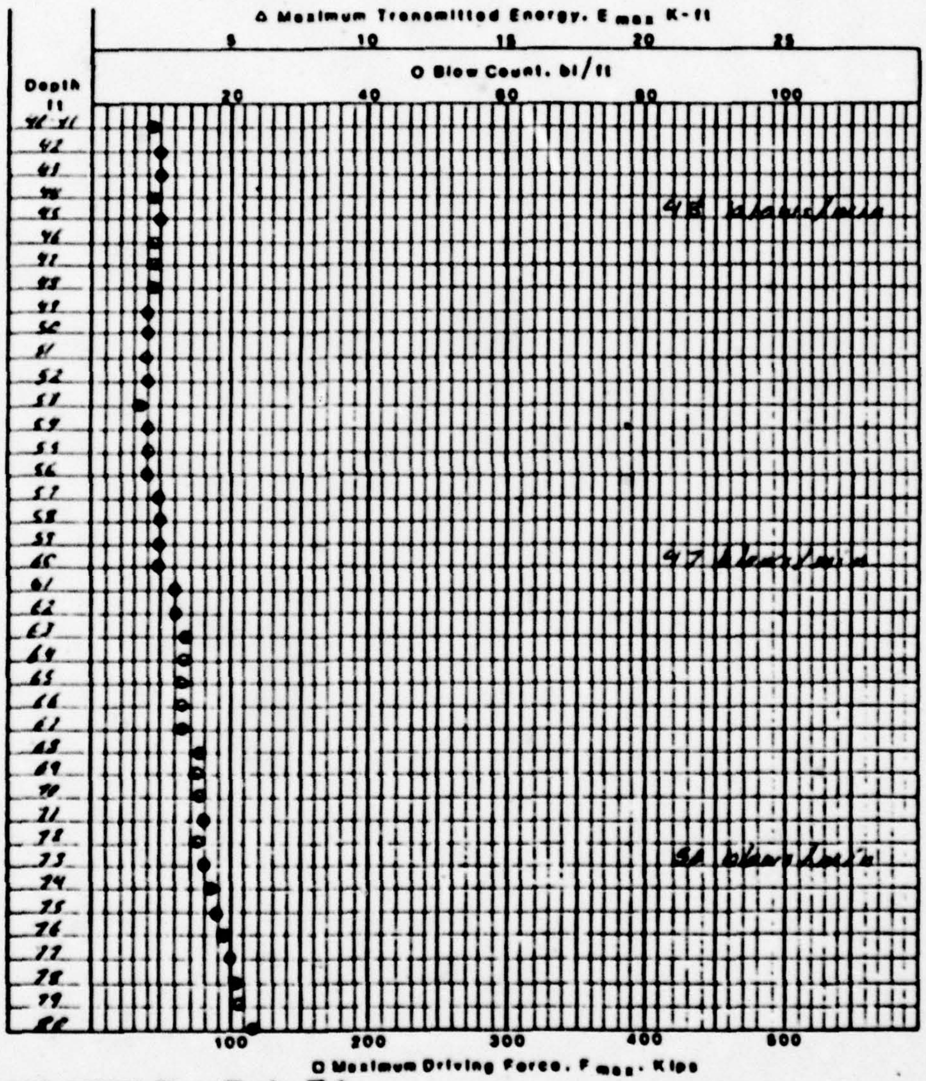
WCC. Y7C825. Phase IV ; Vol. III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

p. 2 of 3
I.D. No. 09/05/180/1/0602
Date 3/21/7?
Operator DA

PILE DRIVING MEASUREMENTS
PILE NO. 06

	Time	Sequence No.
First		
Finish		



WCC. Y7C825. Phase II ; Vol. III A

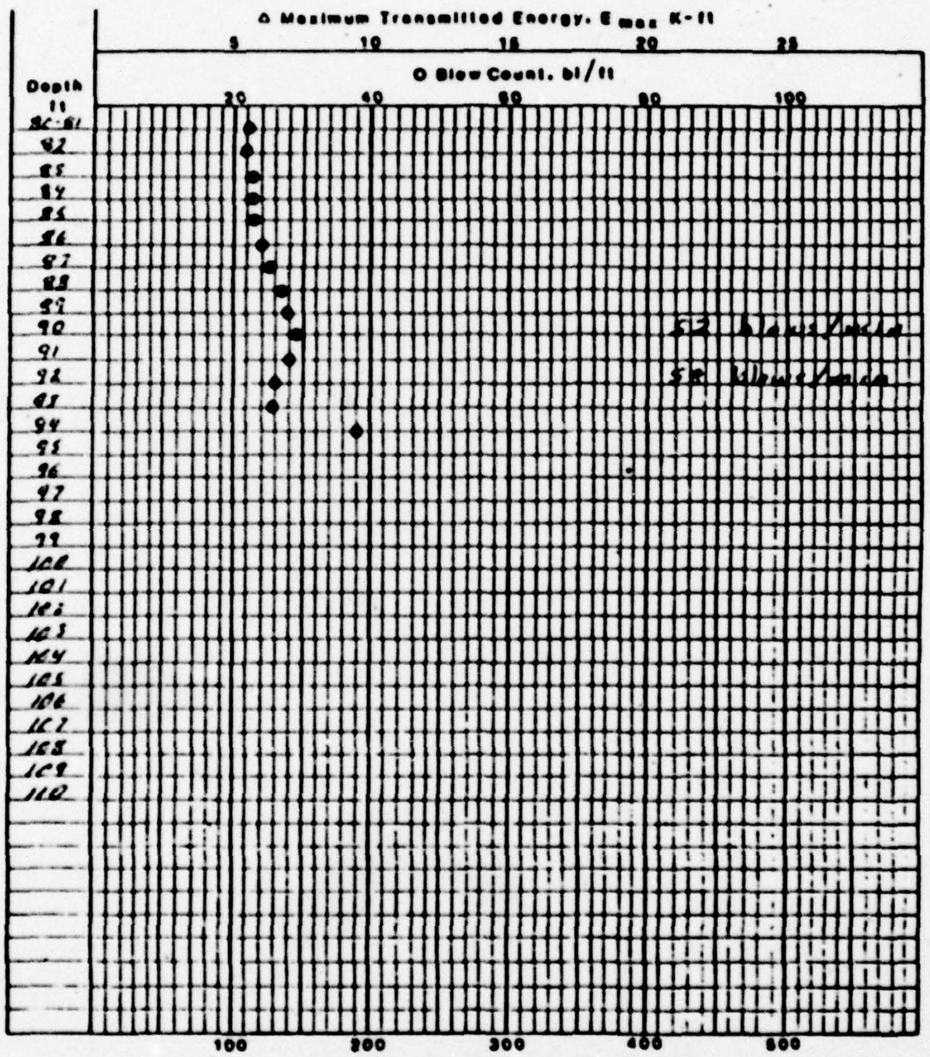
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 3 of 3
I.D. No. 09/05/180/1/0000
Date 2/21/75
Operator DA

PILE DRIVING MEASUREMENTS

PILE NO. 6

	Time	Sequence No.
First		
Finish		



WCC. Y7C025. Phase IV; VOL III A

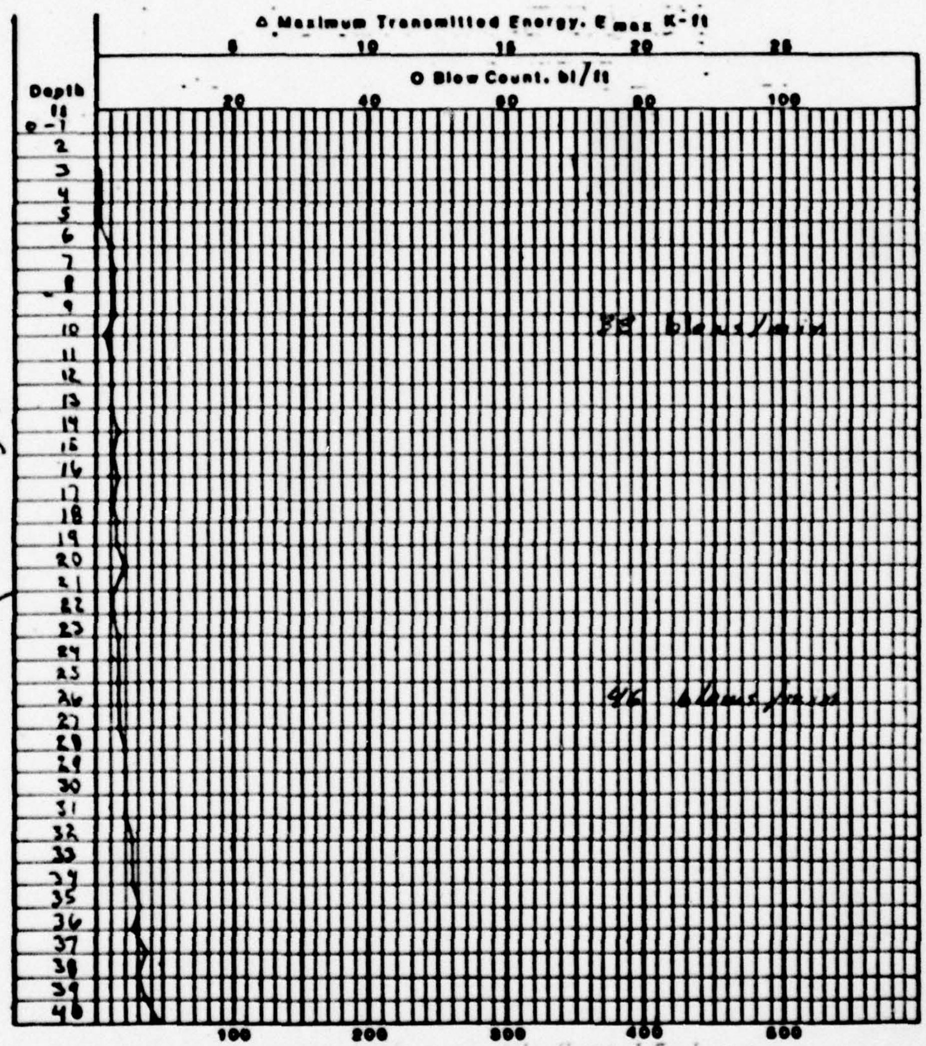
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 1 of 3
I.D. No. 09/05/180/0/0700
Date 2-20-79
Operator JEH

PILE DRIVING MEASUREMENTS
PILE NO. 67

	Time	Sequence No.
First	1753	0701
Finish	12 48	0706

P.D.A. Monitored from 52' → 94'7" only
Problem with gages



WCC. 77C626. Phase III, Vol. III A

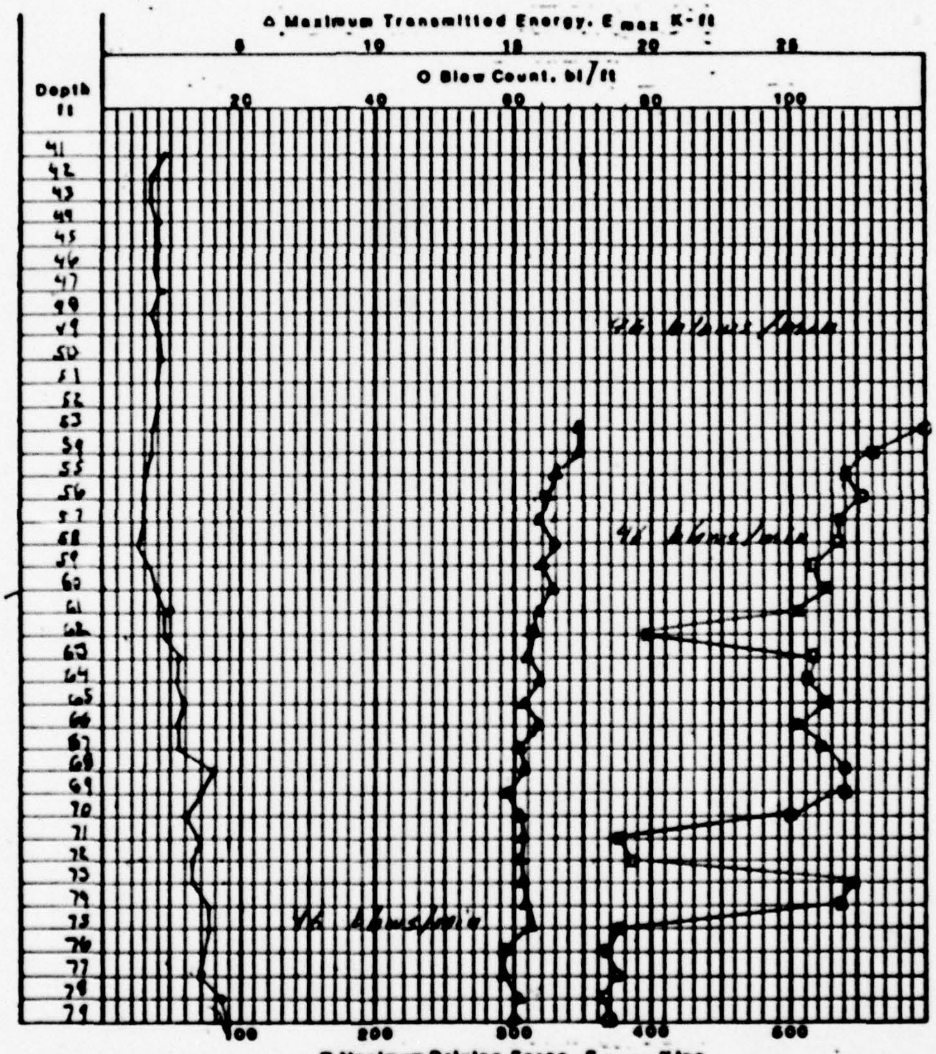
P.D.A. monitored from 52' → 94' 7" only

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 2 of 3
I.D. No. 04/05/180/0/070D
Date 2-20-79
Operator JRH

PILE DRIVING MEASUREMENTS
PILE NO. 07

	Time	Sequence No.
First	1753	0701
Finish	2248	0706



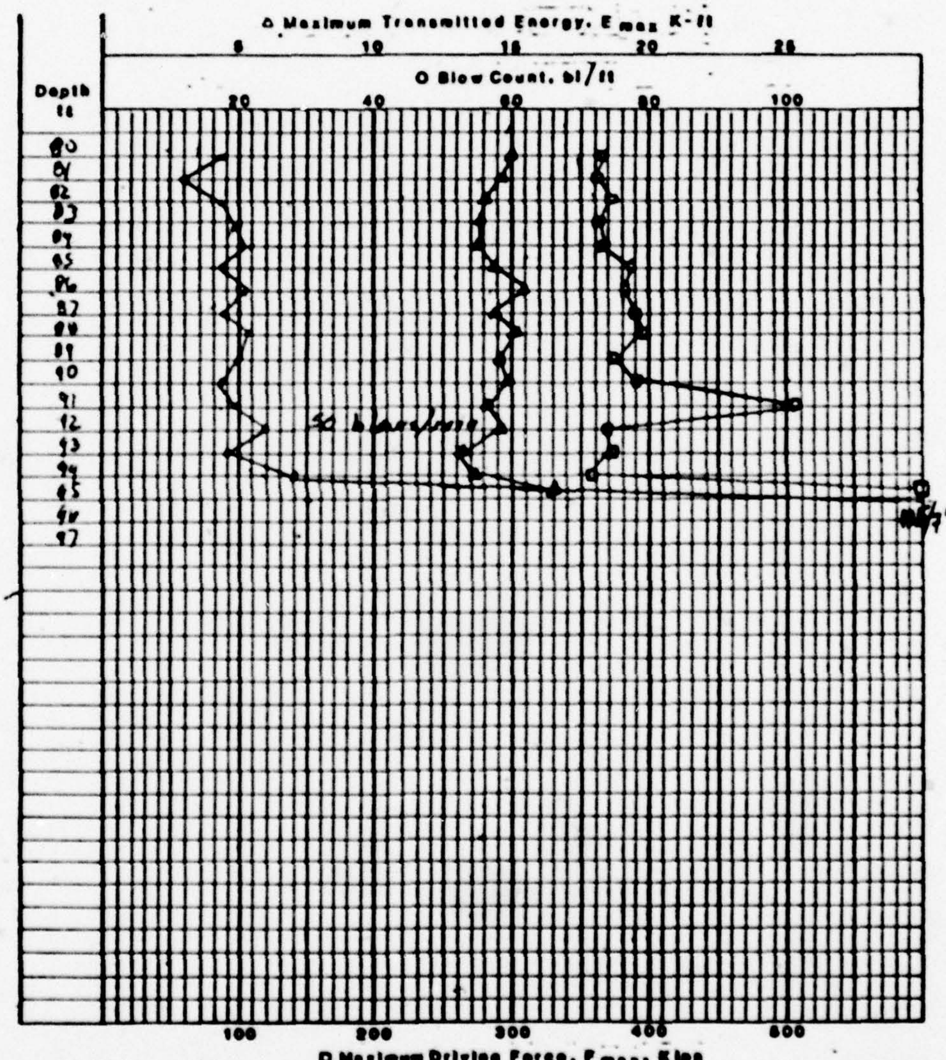
WCC. 77C826. Phase III ; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. 3 of 3
I.D. No. 09/05/10/0/0700
Date 3-10-79
Operator LCH

PILE DRIVING MEASUREMENTS
PILE NO. 07

	Time	Sequence No.
First	1753	0701
Finish	2248	0706



WCC. 77C826. Phase III, VOL II A

P.D.A. monitored piles 7, 25, 41, 67 only

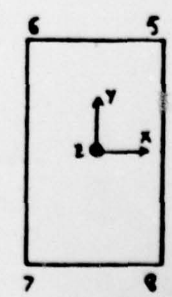
0.6 ABSOLUTE DISPLACEMENTS OF MONOLITH M5

The absolute displacements of monolith during prototype pile driving, presented in Table 0.1 are with respect to the position of monolith, completely unloaded, before prototype pile driving.

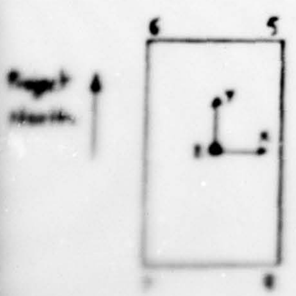
The absolute displacements of monolith, presented in Table 0.2 are with respect to initial monolith position before preloading (no load applied); therefore, these displacement values represent total monolith displacements throughout the tests.

Seq. No. Date/Time of optical survey	Record No. Date/Time of cyber acquisition	Load, I V	Load, I H	Y-Component, in. 5	6	7	8	$\bar{Y}$	5	
				Optical Survey Data / Corrected Cyber Data						
0002	58	123.3	31.7	0.487	0.524	0.471	0.4[illegible]	0.481	-0.070	-0
2/17 / 08.00	2/17 / 10.27			0.489	0.496	0.447	0.410	0.460	-0.078	-0
0102	61	121.9	31.5	0.530	0.562	0.490	0.456	0.511	-0.090	-0
2/17 / 11.30	2/17 / 11.15			0.542	0.535	0.461	0.426	0.491	-0.091	-0
0104	77	123.3	31.4	0.491	0.538	0.528	0.500	0.514	-0.080	-0.
2/17 / 18.45	2/17 / 18.35			0.486	0.499	0.503	0.472	0.490	-0.090	-0
0202	83	124.1	31.9	0.522	0.557	0.561	0.5[illegible]5	0.541	-0.100	-0.
2/17 / 23.30	2/17 / 23.45			0.517	0.535	0.540	0.504	0.524	-0.107	-0.
0204	91	123.8	31.7	0.567	0.614	0.602	0.571	0.589	-0.160	-0.
2/18 / 03.30	2/18 / 03.15			0.545	0.558	0.573	0.538	0.554	-0.160	-0.
0300	415	122.1	31.9	0.574	0.525	0.593	0.550	0.561	-0.150	-0.
2/19 / 08.00	2/19 / 10.01			0.550	0.562	0.581	0.542	0.559	-0.141	-0.
0303	428	123.3	31.5	0.610	0.646	0.630	0.588	0.619	-0.140	-0
2/19 / 17.[illegible]	2/19 / 17.43			0.621	0.619	0.594	0.554	0.597	-0.151	-0
0306	436	122.8	31.5	0.633	0.671	0.659	0.619	0.646	-0.180	-0.
2/19 / 23.00	2/19 / 22.16			0.625	0.633	0.626	0.593	0.620	-0.196	-0
0402	442	123.3	31.5	0.664	0.697	0.691	0.648	0.675	-0.180	-0.
2/20 / 02.30	2/20 / 02.17			0.642	0.646	0.650	0.602	0.635	-0.199	-0
0402	484	124.1	31.5	0.661	0.701	0.676	0.638	0.669	-0.210	-0
2/20 / 07.15	2/20 / 07.13			0.654	0.654	0.632	0.593	0.634	-0.223	-0
0405	424	123.6	31.5	0.682	0.726	0.705	0.660	0.693	-0.230	-0.
2/20 / 11.30	2/20 / 11.43			0.670	0.676	0.673	0.630	0.662	-0.222	-0.
0503	503	123.3	31.5	0.732	0.744	0.762	0.716	0.739	-0.240	-0
2/20 / 16.30	2/20 / 16.24			0.692	0.699	0.718	0.664	0.693	-0.257	-0
0506	512	123.1	31.4	0.823	0.852	0.841	0.794	0.823	-0.300	-0.
2/21 / 01.30	2/21 / 01.32			0.784	0.777	0.790	0.745	0.774	-0.315	-0
0600	575	122.6	31.4	0.807	0.828	0.845	0.806	0.822	-0.350	-0.
2/21 / 07.30	2/21 / 07.02			0.775	0.764	0.798	0.762	0.775	-0.326	-0
0603	593	123.6	31.5	0.831	0.852	0.879	0.833	0.849	-0.340	-0.
2/21 / 11.30	2/21 / 11.[illegible]			0.797	0.788	0.831	0.791	0.802	-0.347	-0
[illegible]	600	123.6	31.5	1.028	1.067	1.059	1.015	1.042	-0.520	-0.
2/21 / [illegible]	2/21 / 17.01			0.985	0.975	0.995	0.9-8	0.976	-0.520	-0.
0703	617	123.3	31.5	1.098	1.123	1.131	1.084	1.109	-0.540	-0.
2/21 / 18.20	2/21 / 18.17			1.038	1.031	1.055	1.008	1.033	-0.557	-0.
0706	625	122.6	31.5	1.194	1.249	1.251	1.189	1.221	-0.640	-0.
2/21 / 23.00	2/21 / 22.53			1.146	1.130	1.151	1.099	1.132	-0.676	-0.
2706	633		0.1	0.677	0.676	0.665	0.639	0.664	-0.530	-0.
2/22 / 02.00	2/22 / 03.03			0.650	0.650	0.611	0.594	0.626	-0.608	-0.

Project North



Y-Component, in.			Z-Component, in.							Remarks
7	8	Ȳ	5	6	56	7	8	78	Z̄	
Optical Survey Data										
Corrected Cyber Data										
0.471	0.4[illegible]	0.481	-0.070	-0.090	-0.080	0.020	0.040	0.030	-0.025	
0.447	0.410	0.460	-0.078	-0.098	-0.088	-0.006	0.015	0.004	-0.042	
0.490	0.456	0.511	-0.090	-0.120	-0.105	0.000	0.010	0.005	-0.050	
0.461	0.426	0.491	-0.091	-0.113	-0.102	-0.013	0.008	-0.003	-0.052	
0.528	0.500	0.514	-0.080	-0.100	-0.090	-0.020	0.040	0.010	-0.040	
0.503	0.472	0.490	-0.090	-0.103	-0.097	-0.015	0.009	-0.003	-0.050	
0.561	0.525	0.541	-0.100	-0.130	-0.115	0.000	0.020	0.010	-0.053	
0.540	0.504	0.524	-0.107	-0.127	-0.117	0.012	0.026	0.019	-0.049	
0.602	0.571	0.589	-0.160	-0.170	-0.165	-0.030	0.000	-0.015	-0.090	
0.573	0.538	0.554	-0.160	-0.166	-0.163	-0.039	-0.019	-0.029	-0.096	
0.593	0.550	0.561	-0.150	-0.170	-0.160	-0.010	0.000	-0.005	-0.083	
0.581	0.542	0.559	-0.141	-0.167	-0.154	-0.005	0.005	0.000	-0.077	
0.630	0.588	0.619	-0.140	-0.180	-0.160	-0.030	0.005	-0.013	-0.086	
0.594	0.554	0.597	-0.151	-0.167	-0.159	-0.018	-0.001	-0.010	-0.084	
0.659	0.619	0.646	-0.180	-0.220	-0.200	-0.010	-0.010	-0.010	-0.105	
0.626	0.593	0.620	-0.196	-0.213	-0.205	-0.019	-0.015	-0.017	-0.111	
0.691	0.648	0.675	-0.180	-0.260	-0.220	-0.030	-0.010	-0.020	-0.120	
0.650	0.602	0.635	-0.199	-0.231	-0.215	-0.027	-0.017	-0.022	-0.118	
0.676	0.638	0.669	-0.210	-0.250	-0.230	-0.040	-0.020	-0.030	-0.130	
0.636	0.593	0.634	-0.223	-0.245	-0.234	-0.040	-0.023	-0.031	-0.133	
0.705	0.660	0.693	-0.230	-0.260	-0.245	-0.040	-0.020	-0.030	-0.132	
0.673	0.630	0.668	-0.222	-0.243	-0.233	-0.037	-0.023	-0.030	-0.131	
0.762	0.716	0.739	-0.240	-0.280	-0.260	-0.070	-0.030	-0.050	-0.155	
0.718	0.664	0.693	-0.257	-0.284	-0.271	-0.061	-0.050	-0.055	-0.163	
0.841	0.794	0.823	-0.300	-0.350	-0.325	-0.110	-0.050	-0.080	-0.203	
0.790	[illegible]	0.774	-0.319	-0.343	-0.327	-0.063	-0.037	-0.051	-0.182	
0.845	0.806	0.822	-0.350	-0.390	-0.370	-0.200	-0.080	-0.140	-0.255	
0.798	0.762	0.775	-0.326	-0.358	-0.342	-0.087	-0.064	-0.075	-0.208	
0.879	0.833	0.849	-0.340	-0.410	-0.375	-0.090	-0.070	-0.080	-0.228	
0.831	0.791	0.808	-0.347	-0.372	-0.360	-0.088	-0.062	-0.075	-0.217	
1.059	1.015	1.042	-0.520	-0.600	-0.560	-0.150	-0.120	-0.135	-0.348	
0.995	0.948	0.976	-0.520	-0.562	-0.541	-0.164	-0.111	-0.137	-0.334	
1.131	1.084	1.109	-0.540	-0.670	-0.605	-0.190	-0.140	-0.165	-0.385	
1.055	1.008	1.033	-0.557	-0.607	-0.582	-0.162	-0.110	-0.136	-0.359	
1.251	1.189	1.221	-0.640	-0.740	-0.690	-0.200	-0.170	-0.185	-0.438	
1.151	1.099	1.132	-0.676	-0.711	-0.694	-0.179	-0.147	-0.163	-0.428	
0.665	0.637	0.664	-0.530	-0.620	-0.575	-0.200	-0.200	-0.200	-0.388	After removal of axial
0.611	0.594	0.626	-0.608	-0.629	-0.619	-0.192	-0.172	-0.182	-0.400	and lateral loads



PILE DRIVING EFFECTS TEST PROGRAM

ABSOLUTE DISPLACEMENTS OF MONOLITH M5 DURING PROTOTYPE PILE DRIVING

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS

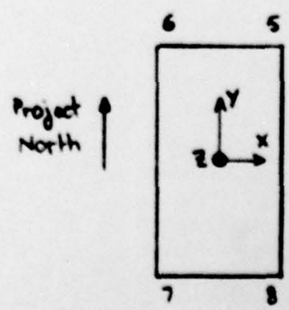
Woodward-Clyde Consultants

Phase II; Vol. IIIA

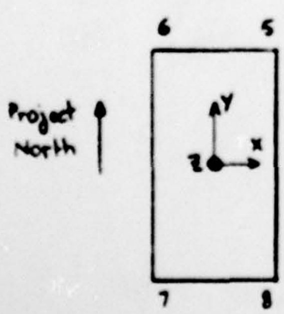
Table O.1

2

Displacements	Horizontal displacement, in. 5	6	7	8	Average	5
	Reference point data / Corrected linear potentiometer					
at the end of preloading (monolith axially and laterally unloaded)	0.518	0.386	0.390	0.470	0.441	0.105
	0.468	0.461	0.471	0.462	0.465	0.146
prior to prototype pile driving (monolith axially and laterally loaded)	1.005	0.910	0.861	0.911	0.922	0.175
	0.957	0.957	0.918	0.872	0.926	0.224
at the end of prototype pile driving (monolith axially and laterally loaded)	1.712	1.635	1.641	1.659	1.662	0.745
	1.614	1.591	1.622	1.561	1.597	0.822
prior to load testing (monolith axially and laterally unloaded)	1.140	1.036	1.035	1.078	1.072	0.665
	1.118	1.111	1.083	1.056	1.091	0.754



...al displacement, in.			Settlement, in.						
7	8	Average	5	6	North Average	7	8	South Average	Average
...: Reference point data / Corrected linear potentiometer data									
...390	0.470	0.441	0.105	0.225	0.165	0.110	0.035	0.073	0.119
...471	0.462	0.465	0.146	0.159	0.153	0.055	0.040	0.047	0.100
...861	0.911	0.922	0.175	0.315	0.245	0.090	-0.005	0.043	0.144
...918	0.872	0.926	0.224	0.257	0.241	0.061	0.025	0.043	0.142
...641	1.659	1.662	0.745	0.965	0.855	0.310	0.205	0.258	0.556
...622	1.561	1.597	0.822	0.870	0.846	0.247	0.212	0.230	0.500
...035	1.078	1.072	0.665	0.845	0.755	0.310	0.195	0.253	0.504
...083	1.056	1.091	0.754	0.788	0.772	0.247	0.212	0.229	0.500



1 2

PILE DRIVING EFFECTS TEST PROGRAM

ABSOLUTE DISPLACEMENTS OF MONOLITH M5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. [illegible]
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-[illegible]

Woodward-Clyde Consultants
[illegible] Phase III ; Vol. III A

Table 0.1

Y7C-825
Phase IV ; VOL III A

0.7 INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR PROTOTYPE PILES OF MONOLITH M5

Monolith M5, Prototype Pile No. 1, Pile Type HP 14x73
Final Pile Penetration 105 ft

Sequence No.		0101			0102			0103			0104			End of Pile		
Pile Penetration - ft		1'6"			26'6"			[illegible]			[illegible]			[illegible]		
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1																
2	M1		V			V			V			V				
3																
4	M2															
5																
6	M3															
7	F1		X			X			X			X				
8																
9	F2		X			X			X			X				
10																
11	F3		X			X			X			X				
12	~~G14~~															
13	G10-1		V	X		V	X		V	X		V	X			
14	G13-1		X			X			X			X				
15	G10-15			X			X			X			X			
16	G13-15			X			X			X			X			
17	G10-50			X			X			X			X			
18	G13-50															

Monolith M5, Prototype Pile No. 2, Pile Type HP 14x73
Final Pile Penetration 96 ft

Sequence No.		0201			0202			0203			0204			End of Pile		
Pile Penetration - ft		5'6"			25			52'10"			76			96		
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1																
2	M1		V			V			V			V			V	
3																
4	M2															
5																
6	M3															
7	F1		X			X			X			X			X	
8																
9	F2		X			X			X			X			X	
10																
11	F3		X			X			X			X			X	
12	~~G14~~															
13	G10-1		V	X		V	X		V	X		V	X		V	X
14	G13-1		X			X			X			X			X	
15	G10-15			X			X			X			X			X
16	G13-15			X			X			X			X			X
17	G10-50			X			X			X			X			X
18	G13-50															

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component

SA or PVM : Peak Vibration Monitor
Osc. : Oscillograph
Tape : Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITH M5 PROTOTYPE PILES No. 1 and 2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0000

Woodward-Clyde Consultants

[illegible] PHASE III ; VOL II A

Monolith M5, Prototype Pile No. 3, Pile Type HP 14x73
Final Pile Penetration 95 ft

Sequence No.		0301			0302			0303			0304			0305			0306			end of pile		
Pile Penetration ft		4'6"			17'			35'3"			51'4"			65			80			95		
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1																						
2	M1		V			V	X		V	X		V			V			V				
3																						
4	M2																					
5																						
6	M3																					
7	F1		X			X			X			X			X			X				
8																						
9	F2		X			X			X			X			X			X				
10																						
11	F3		X			X			X			X			X			X				
12	[illegible]																					
13	G10-1		V	X		V	X		V	X		V	X		V	X		V	X			
14	G13-1		X			X			X			X			X			X				
15	G10-15			X			X			X			X			X			X			
16	G13-15			X									X			X			X			
17	G10-50			X			X			X			X			X			X			
18	G13-50																					

Monolith M5, Prototype Pile No. 4, Pile Type HP 14x73
Final Pile Penetration 94.7 ft

Sequence No.		0401			0402			0403			0404			0405		
Pile Penetration ft		2'10"			25			56'6"			75			85		
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1																
2	M1		V			V			V			V			V	
3																
4	M2															
5																
6	M3															
7	F1		X			X			X			X			X	
8																
9	F2		X			X			X			X			X	
10																
11	F3		X			X			X			X			X	
12	[illegible]															
13	G10-1		V	X		V	X		V	X		V	X		V	X
14	G13-1		X			X			X			X			X	
15	G10-15			X			X			X			X			X
16	G13-15			X			X			X			X			X
17	G10-50			X			X			X			X			X
18	G13-50															

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

- X all 3 components
- T x component
- L y component
- V z component

SA or PVM : Peak Vibration Monitor
Osc. : Oscillograph
Tape : Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITH M5 PROTOTYPE PILES No. 3 and 4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0000

Woodward-Clyde Consultants

77C029 Phase III ; VOL III A

Monolith M5 , Prototype Pile No. 5 , Pile Type HP 14x73
Final Pile Penetration 95.25 ft

Sequence No.		0501			0502			0503			0504			0505			0506			end of pile											
Pile Penetration ft		5'6"			15'			35'			52'			65			80			95'3"											
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1																															
2	M1		V			V			V			V			V			V													
3																															
4	M2																														
5																															
6	M3																														
7	F1		X			X			X			X			X			X													
8																															
9	F2		X			X			X			X			X			X													
10																															
11	F3		X			X			X			X			X			X													
12	[redacted]																														
13	G10-1		V	X		V	X		V	X		V	X		V	X		V	X												
14	G13-1		X			X			X			X			X			X													
15	G10-15			X			X			X			X			X			X												
16	G13-15			X			X			X			X			X			X												
17	G10-50			X			X			X			X			X			X												
18	G13-50																														

Monolith M5 , Prototype Pile No. 6 , Pile Type HP 14x73
Final Pile Penetration 94.5 ft

Sequence No.		0601			0602			0603			0604			0605			0606								
Pile Penetration ft		4'			15"			31"			53'			65'			80'								
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1																									
2	M1		V			V			V			V			V			V							
3																									
4	M2																								
5																									
6	M3																								
7	F1		X			X			X			X			X			X							
8																									
9	F2		X			X			X			X			X			X							
10																									
11	F3		X			X			X			X			X			X							
12	[redacted]																								
13	G10-1		V	X		V	X		V	X		V	X		V	X		V	X						
14	G13-1		X			X			X			X			X			X							
15	G10-15			X			X			X			X			X			X						
16	G13-15			X			X			X			X			X			X						
17	G10-50			X			X			X			X			X			X						
18	G13-50																								

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component

SA or PVM : Peak Vibration Monitor
Osc. : Oscillograph
Tape : Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITH M5 PROTOTYPE PILES No. 5 and 6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-[illegible]

Woodward-Clyde Consultants
[illegible] Phase III ; Vol III A

Monolith M5 , Prototype Pile No. 7 Pile Type HP 14x73
Final Pile Penetration 94.6 ft

Sequence No.		0701			0702			0703			0704			0705			0706			end of pile											
Pile Penetration ft		2'6"			30'6"			35			52			65			80			94'7"											
Junction Box Channel	Geophone No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1																															
2	M1		V			V			V			X			X			X													
3																															
4	M2											X			X			X													
5																															
6	M3											X			X			X													
7	F1		X			X			X			X			X			X													
8																															
9	F2		X			X			X																						
10																															
11	F3		X			X			X			V			V			V													
12	G14																														
13	G10-1		V	X		V	X		V	X			X			X			X												
14	G13-1		X			X			X			V			V			V													
15	G10-15			X			X			X			X			X			X												
16	G13-15			X			X			X			X			X			X												
17	G10-50			X			X			X			X			X			X												
18	G13-50																														

Note: Geophones MG1, MG2 and MG3 are represented as M1, M2 and M3.

Legend

X all 3 components
T x component
L y component
V z component

SA or PVM : Peak Vibration Monitor
Osc. : Oscillograph
Tape : Analog Magnetic Tape

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR MONOLITH M5 PROTOTYPE PILE No. 7

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0085

Woodward-Clyde Consultants

77C025 Phase II ; Vol. III A

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Phase IV ; Vol III A

0.8 INFORMATION DIGITIZED FROM ANALOG MAGNETIC TAPE FOR MONOLITH M5

Geophone No.	Prototype Pile No and Depth of Digitization (ft)						
	1	2	3	4	5	6	7
G15-1		50 70 95	50 70			60	58
G13-1		50 70 95	50 70			60	
F2		50 70 95	50 70			60	
F3		50 70 95	50 70			60	
MG1							58
MG2							58
MG3							58

Depth of Digitization is the prototype pile tip depth at which the digitized data recorded during the tests on analog magnetic tape, were processed through a computer.

PILE DRIVING EFFECTS TEST PROGRAM

INFORMATION DIGITIZED FROM ANALOG MAGNETIC TAPE FOR MONOLITH M5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-[illegible]-C-[illegible]

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77C020 Phase III ; Vol III A

PHASE IV REPORT

VOLUME IIIA

RESULTS AND INTERPRETATION OF
PILE DRIVING EFFECTS TEST PROGRAM

APPENDIX P

MEASUREMENT DETAILS
MONOLITHS M6 AND M7

TABLE OF CONTENTS

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Phase IV; Vol III A

P MEASUREMENT DETAILS, MONOLITHS M6 and M7

P.1 COMPLETE FIELD LOG OF INSTALLATION OF TIMBER PILE UNDER MONOLITH M6

The identification number (Id. No.) at the top right-hand corner of the data sheet includes the timber pile number shown in Fig. 3.2, Volume III.

The timber pile number is given by the two digits preceeding the last two zeros of the Id. No. (page P-2 corresponds to timber pile No. 25)

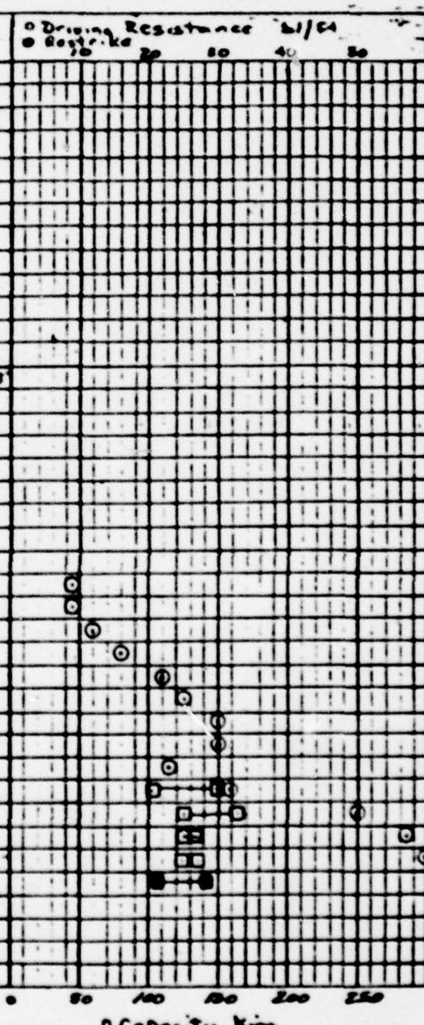
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

P. __ of __

ID No. 08 06 160 1 2500

Pile Type	Douglas Fir	Hammer	Vulcan V1	Date	10/22/78
Pile length	42.1	Energy	15,000 ft-lbs	Time	13:18 – 14:28
Ground el.	Trench Bed	Operating Rate	50 blows/min	Inspector	[illegible]

Depth ft	Blows	Remarks
0-1		
2		Pre-jet to 24'
3		Pile [illegible] to 21'
4		
5		
6		
7		
8		
9		
10		[illegible] 10-13', [illegible] at 10'
11		
12		
13		
14		[illegible] w/ good [illegible] 1'-2'-2.5'
15		Lose circulation
16		
17		
18		
19		
20		Lose calculation
21		
22	No Data taken	
23	9	
24	9	
25	12	
26	16	
27	22	
28	25	
29	30	[illegible]
30	30	Analyzer
31	23	
32	32	
33	50	
34	57	
35	15 for 3"	
	44 for 1"	Restrike on 10/26/78
		at 01:[illegible]



Dynamic measurements YES

Sequence No.	Depth ft
01 (PDA)	30 - 34.25
02 (Restrike)	34.25 - 34.75

Notes:
Pile batter at E.O.D.
1.3% N
1.9% E

[illegible]
10 Oct '78

WCC, TTC BIS, Phase II
Vol III A

AD-A076 094 WOODWARD-CLYDE CONSULTANTS CHICAGO IL F/G 13/2
RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM--ETC(U)
JUL 79 J PEREZ , D M HOLLOWAY DACW43-78-C-0005

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6 OF 6
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END
DATE
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11-79
DDC

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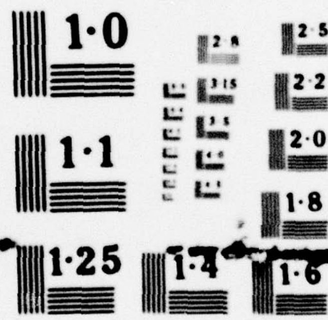
DATE
FILMED
11-79
DDC



NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

Y7C-825
PHASE IV; VOL III A

P.2 SUMMARY LOG OF DATA ACQUIRED DURING PRELOADING, MONOLITH M6

ID No.: 07-06

MONOLITH(S) TESTED: M6

TEST TYPE: PRELOADING

	Sequence No.	0070	0087			
	Date/Time	1/19/79 1930	1/20/79 0400			
	Description of Event	30k AXIAL 0k LATERAL LOADS	30k AXIAL 6k LATERAL LOADS CYCLE 10			
PRIMARY DATA	Dial Gages, P(1)	✓	✓			
	Optical Horizontal Control, P(1)	N REF BEAM AT M1	N REF BEAM AT M1			
	Optical Vertical Control, P(1)					
	Tape Extensometer, P(1)					
	Tilt Meters, P(1)	✓				
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)					
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)					
	Thermo-couples, S(14)					
	Strain Gages, S(10)		✓			
	Record No. – 02		10			
	Record No. – 03					

Note: ✓ = Complete set of readings taken

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Phase IV ; Vol III A

P.3 SUMMARY LOG OF DATA ACQUIRED DURING PILE DRIVING , MONOLITH M6

See Appendix M, Section M.3

Y7C-825
Phase IV ; Vol III A

P.4 SUMMARY LOG OF DATA ACQUIRED DURING AXIAL AND LATERAL LOAD TESTINGS, MONOLITH M6

ID No.: 10-06

MONOLITH(S) TESTED: M6

TEST TYPE: LOAD TEST

	Sequence No.	0000	0002	0004	0007	0011
	Date/Time	2/9/79 1500	2/9/79 1800	2/9/79 2120	2/10/79 0145	2/10/79 0800
	Description of Event	UNLOADED INITIALIZE	30t AXIAL ZERO LATERAL LOADS	60t AXIAL ZERO LATERAL LOADS	90t AXIAL ZERO LATERAL LOADS	110t AXIAL ZERO LATERAL LOADS
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, N REF BM P(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)					
	Tilt Meters, P(1)	BROKEN PEGS				
SECONDARY DATA	Timber Pile Inclinometers, S(9)	NOT POSSIBLE				
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	✓
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)					
	Strain Gages, S(10)	NONE →				
	Record No. – 02					
	Record No. – 03					

Note: ✓ = Complete set of readings taken

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Phase IV ; Vol. II A

ID No.: 10-06

MONOLITH(S) TESTED: M6

TEST TYPE: LOAD TEST

	Sequence No.	0100	0101	0102	0104	0107
	Date/Time	2/10/79 1230	2/10/79 1520	2/10/79 1730	2/10/79 2010	2/10/79 2300
	Description of Event	30t AXIAL 3t LATERAL LOADS	30t AXIAL 6t LATERAL LOADS	30t AXIAL 9t LATERAL LOADS	30t AXIAL 12t LATERAL LOADS	30t AXIAL 15t LATERAL LOADS
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	✓
	Optical Horizontal Control, N & E of BAP(1)	✓	✓	✓	✓	✓
	Optical Vertical Control, P(1)	✓	✓	✓	✓	✓
	Tape Extensometer, P(1)					
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓	✓	✓	✓	✓
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)	✓	✓	✓	✓	✓
	Thermo-couples, S(14)					
	Strain Gages, S(10)					
	Record No. – 02					
	Record No. – 03					

Note: ✓ = Complete set of readings taken

Y7C-325
Phase IV; VOL IIA

ID No.: 10-06

MONOLITH(S) TESTED: M6

TEST TYPE: LOAD TEST

	Sequence No.	0110				
	Date/Time	2/12/79 0740				
	Description of Event	FULLY UNLOADED				
PRIMARY DATA	Dial Gages, P(1)	✓				
	Optical Horizontal Control, N ECF B4 P(1)	✓				
	Optical Vertical Control, P(1)	✓				
	Tape Extensometer, P(1)					
	Tilt Meters, P(1)					
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)	✓				
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)					
	Thermo-couples, S(14)					
	Strain Gages, S(10)					
	Record No. – 02					
	Record No. – 03					

Note: ✓ = Complete set of readings taken

P.5 COMPLETE DRIVING RECORDS OF PROTOTYPE PILES DRIVEN WITH IMPACT HAMMERS, MONOLITH M6

The driving records are presented in chronological order of driving for prototype piles No. 1 through 6, driven with a Vulcan 010 hammer and prototype piles No. 7, 8, 13, 14 driven with a MKT DE 70B hammer.

See Appendix M, section M.5

P.6 ABSOLUTE DISPLACEMENTS OF MONOLITH M6

The absolute displacements of monolith during prototype pile driving, presented in Tables P.1a and P.1b, are with respect to the position of monolith, axially loaded and laterally unloaded, before prototype pile driving.

The absolute displacements of monolith, presented in Table P.2, are with respect to initial monolith position before preloading (no load applied); therefore, these displacement values represent total monolith displacements throughout the tests.

0208	382	29.8	5.7
1/26/20:00	1/26/20 06		
0303	395	29.9	5.9
1/27/00:30	1/27/03:09		
0306	459	29.6	5.7
1/27/13:39	1/27/13:37		
0403	475	29.8	5.8
1/27/19:15	1/27/20:21		
0405	481	29.7	5.8
1/28/07:10	1/28/07:01		
0503	486	30.0	5.8
1/29/12:20	1/29/14:30		
0504	494	30.1	5.6
1/29/17:00	1/29/19:25		
0605	507	30.1	5.7
1/30/01:45	1/30/02:12		

Y-Component, in. Bottom (1)	Y-Component, in. Top (2)	Z-Component in. (2)	Remarks
Corrected Cyber Data			
0.425	0.621	-0.208	
0.431	0.627	-0.184	
0.480	0.687	-0.215	
0.483	0.683	-0.255	
0.513	0.727	-0.265	
0.525	0.730		No vertical control data Printer inoperable for load level
0.600	0.815	-0.320	
0.647	0.874	-0.351	
0.687	0.916	-0.363	
0.732	0.959	-0.412	
0.817	1.058	-0.503	
0.843	1.087	-0.538	
0.945	1.198	-0.623	
1.007	1.270	-0.647	
1.153	1.421	-0.774	
1.061	1.316	-0.810	
1.261	1.528	-0.866	
1.270	1.540	-0.902	
1.362	1.652	-0.998	

surface
surface

Project North

PILE DRIVING EFFECTS TEST PROGRAM

ABSOLUTE DISPLACEMENTS OF MONOLITH M6 DURING PROTOTYPE PILE DRIVING

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0001

Woodward-Clyde Consultants | Table P.1a

770020 Phase II : Vol. IIA

1 2

20	29.7	5.7
2/03/01:57		
74	30.1	5.7
2/03/14:41		
80	30.0	5.7
•/03/18:05		
92	29.8	5.8
2/03/21:00		
105	30.7	0.0
2/04/02:01		

5.7	2.070	2.267	−1.674	
5.7	1.977	2.255	−1.586	
5.7	2.084	2.409	−1.592	
5.8	2.291	2.615	−1.687	
0.0	1.804	2.052	−1.482	After removal of horizontal load

Displacements	Horizontal displacement, in. (measured at 33 in. above ground surface)	Settlement, in. (measured at 33 in. above ground surface)
at the end of preloading (monolith only laterally unloaded)	0.422	0.278
prior to prototype pile driving (monolith axially and laterally loaded)	1.043	0.486
at the end of prototype pile driving (monolith axially and laterally loaded)	3.037	1.965
prior to load testing (monolith axially and laterally unloaded)	2.474	1.760

PILE DRIVING EFFECTS TEST PROGRAM

ABSOLUTE DISPLACEMENTS OF MONOLITH M6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0000

Woodward-Clyde Consultants

VFC028 Phase III ; VOL IV A

Table P.2

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Phase IV ; VOL III A

P.7 INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR PROTOTYPE PILES OF MONOLITH M6

See Appendix M, Section M.7

P.8 INFORMATION DIGITIZED FROM ANALOG MAGNETIC TAPE FOR MONOLITH M6

See Appendix M, Section M.8

Y7C-825
Phase IV ; Vol III A

P.9 COMPLETE FIELD LOG OF INSTALLATION OF TIMBER PILE UNDER MONOLITH M7

The identification number (Id. No.) at the top right-hand corner of the data sheet includes the timber pile number shown in Fig. 5.2, Volume III.

The timber pile number is given by the two digits preceeding the last two zeros of the Id. No. (page P-14 corresponds to timber pile No. 45)

R14

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

P. __ of __

ID No. 08 07 160 1 4500

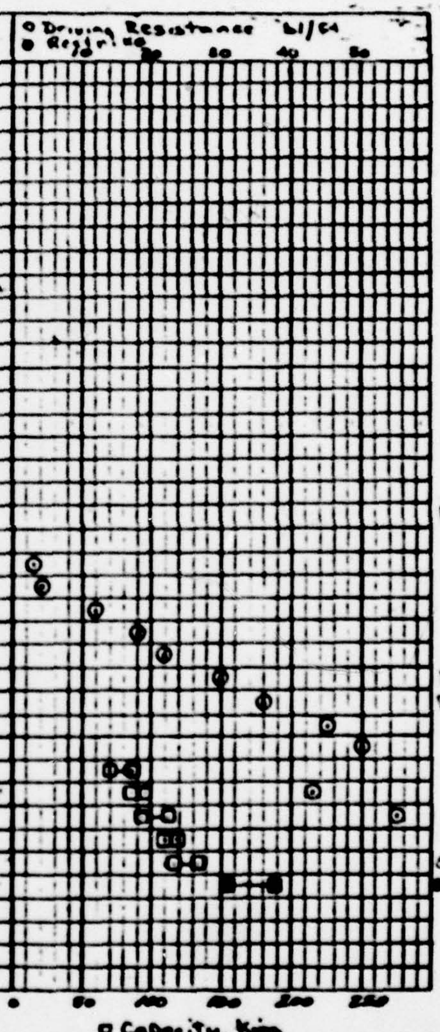
PILE DRIVING RECORD

Pile Type: Douglas Fir
Pile length: 42.0
Ground el.: Trench level

Hammer: Vulcan V1
Energy: 15,000 ft-lbs
Operating Rate: 60 blows/min

Date: 10/23/78
Time: 13.50 – 15.47
Inspector: [illegible]

Depth ft	Blows	Remarks
0-1		
2		Pre-jet to 27'
3		Pile rams to 21'
4		
5		
6		
7		
8		
9		
10		[illegible] loss circulation
11		
12		
13		
14		
15		[illegible]
16		
17		
18		
19		
20		
21		[illegible] at 21 - 22'
22	3	
23	4	
24	12	
25	18	
26	22	
27	30	
28	36	58 blows/min
29	45	
30	50	60 blows/min
31	17	Jet at 30'
32	43	Pulled jet to 30'
33	55	
34		[illegible]
35	60/11"	during the 1st part of driving
	55 for 3½"	Restruck on 10/15/78 at 10 20 hrs



Dynamic measurements: PDA

Sequence No.	Depth ft
01 (PDA)	30 - 34.9
02 (Restrike)	34.9 - 35.1

Notes:
Pile batter at E.A.O.
1.6 % N
1.1 % E

WCC, 77C015, Phase II, VOL II A

J.H.E.L.
[illegible]

Y7C-825
Phase IV ; Vol II A

P.10 SUMMARY LOG OF DATA ACQUIRED DURING PRELOADING, MONOLITH M7

See Appendix N, section N.2

P.11 SUMMARY LOG OF DATA ACQUIRED DURING PILE DRIVING, MONOLITH M7

See Appendix N, section N.3

P.12 SUMMARY LOG OF DATA ACQUIRED DURING LATERAL LOAD TESTING, MONOLITH M7

ID No.: 10-07-

MONOLITH(S) TESTED: M7

TEST TYPE: LOAD TEST

	Sequence No.	0000	0002	0003	0004	
	Date/Time	3/10 0500	3/10 0915	3/10 1310	3/10 1520	
	Description of Event	INITIALIZATION M7	V = 30t H = 6t	V = 30t H = 12t	V = 30t H = 15t	
PRIMARY DATA	Dial Gages, P(1)	✓	✓	✓	✓	
	Optical Horizontal Control, P(1)	✓	ref beams only	ref beams only	ref beams only	
	Optical Vertical Control, P(1)	✓	✓	✓	✓	
	Tape Extensometer, P(1)	✓	✓	✓	✓	
	Tilt Meters, P(1)	✓	✓	✓	✓	
SECONDARY DATA	Timber Pile Inclinometers, S(9)					
	Timber Pile Slopes, S(9)					
	Tell Tales, S(10)		✓			
	Surface Settlement, S(11)					
	Ground Inclinometers, S(12)					
	Sondex, S(12)					
	Piezometers, S(13)		✓	✓	✓	
	Thermo-couples, S(14)		✓	✓	✓	
	Strain Gages, S(10)	✓	✓	✓	✓	
	Record No. – 02	BALANCE	6, 7, 8	9	10	
	Record No. – 03					

Note: ✓ = Complete set of readings taken

P.13 COMPLETE DRIVING RECORDS OF PROTOTYPE PILES DRIVEN WITH IMPACT HAMMER, MONOLITH M7

The driving records are presented in chronological order of driving for prototype piles No. 1 through 8, driven with a Vulcan 010 hammer.

See Appendix N, section N.5

P.14 ABSOLUTE DISPLACEMENTS OF MONOLITH M7

The absolute displacements of monolith during prototype pile driving, presented in Table P.3 are with respect to the position of monolith, completely unloaded, before prototype pile driving.

The absolute displacements of monolith, presented in Table P.4 are with respect to initial monolith position before preloading (no load applied); therefore, these displacement values represent total monolith displacements throughout the tests.

0203 3/03/08:30	106 3/03/08:46	30.2	5.8	0.578	1.061
0203 3/03/08:00	157 3/03/09:21	30.2	5.9	0.589	1.103
0302 3/03/14:00	165 3/03/16:08	30.3	5.8	0.679	1.257
0303 3/03/18:00	181 3/03/20:30	32.6	5.7	0.929	1.740
0402 3/03/23:20	192 3/04/01:37	30.0	6.0	0.962	1.834
0403 3/05/08:00	532 3/05/09:30	29.2	5.9	0.934	1.812
0405 3/05/16:30	549 3/05/15:57	30.1	5.9	0.982	1.880
0502 3/05/22:00	562 3/05/23:10	30.1	5.9	0.979	1.881
0504 3/06/00:30	570 3/06/01:31	29.6	5.8	1.004	1.923
0504 3/06/08:00	626 3/06/08:19	30.0	5.9	1.136	2.121
0504 3/06/12:00	635 3/06/13:29	30.0	5.9	1.228	2.312
0604 3/06/16:00	648 3/06/16:49	29.8	5.8	1.240	2.365
0606 3/06/21:00	655 3/06/22:35	30.0	5.8		2.548
0703 3/07/00:30	665 3/07/01:31	30.0	5.8	1.536	2.877
0703 3/07/08:00	718 3/07/09:39	30.0	5.9	1.634	2.966
0803 3/07/13:00	730 3/07/14:49	30.0	5.9	1.718	3.229

-0.583	
-0.651	
-0.850	
-0.958	
-0.862	
-0.903	
-0.883	
-0.914	
-1.062	
-1.145	
-1.160	
-1.258	Printer inoperable
-1.233	
-1.573	

Displacements	Horizontal displacement, in. (measured at 31 in. above ground surface)	Settlement, in. (measured at 7 in. above ground surface)
at the end of preloading (monolith axially and laterally unloaded)	0.231	0.080
prior to prototype pile driving (monolith axially and laterally loaded)	1.128	0.547
at the end of prototype pile driving (monolith axially and laterally loaded)	3.460	1.499
prior to load testing (monolith axially and laterally unloaded)	1.613	

PILE DRIVING EFFECTS TEST PROGRAM

ABSOLUTE DISPLACEMENTS OF MONOLITH M7

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-[illegible]

Woodward-Clyde Consultants

[illegible] Phase III : Vol. III A

Table P. 4

Y7C-825
Phase IV ; VOL III A

P.15 INFORMATION ACQUIRED BY DYNAMIC DATA ACQUISITION SYSTEM FOR PROTOTYPE PILES OF MONOLITH M7

See Appendix N, Section N.7

P.16 INFORMATION DIGITIZED FROM ANALOG MAGNETIC TAPE FOR MONOLITH M7

See Appendix N, Section N.8

PHASE IV REPORT

VOLUME IIIA

RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM

APPENDIX Q

MEASUREMENT DETAILS MONOLITHS M4 AND M8

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Phase IV; Vol III A

Q MEASUREMENT DETAILS, MONOLITHS M4 and M8

Q.1 COMPLETE FIELD LOGS OF INSTALLATION OF TIMBER PILES UNDER MONOLITH M4

The identification number (Id. No.) at the top right-hand corner of each data sheet includes the timber pile number shown in Fig. 5.2, Volume III.

The timber pile number is given by the two digits preceeding the last two zeros of the Id. No. (for example, page Q-2 corresponds to timber pile No. 36)

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

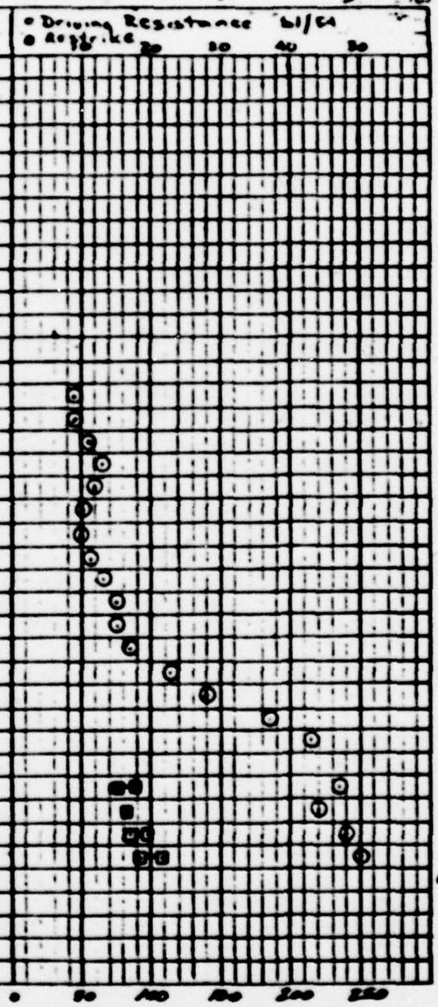
PILE DRIVING RECORD

ID No. 03 04 160 1 3600

P __ of __

Pile Type	Douglas Fir	Hammer	Vulcan V1	Date	10/24/78
Pile length	47.7 ft	Energy	15,000 ft-lbs	Time	7:00 – 11:40
Ground el.	Trench level	Operating Rate	60 blows/min	Inspector	[illegible] D. T. [illegible]

Depth ft	Blows	Remarks
0-1		
2		Pre-jet to 27' depth
3		Pile [illegible] to 14
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15	9	
16	9	
17	11	[illegible]
18	13	[illegible]
19	12	
20	10	
21	10	
22	11	
23	13	
24	15	
25	15	
26	17	
27	23	
28	28	
29	37	
30	43	
31	No Data	Analyzer
32	47	
33	44	
34	48	
35	42 for 10"	
	31 Blows for	Restrike on 10/25/78
	3.5'	at 08 20 hrs



■ Restrike
▽ Jetting

Dynamic measurements yes

Sequence No.	Depth ft
01 (PDP)	30 - 34.9
02 (Restrike)	34.5 - 35.3

Notes:
Rio batter at E.O.D.
1.4% N
0.6% W

√ [illegible]
[illegible] '78

WCC, 77C 825, Phase II
VOL III A

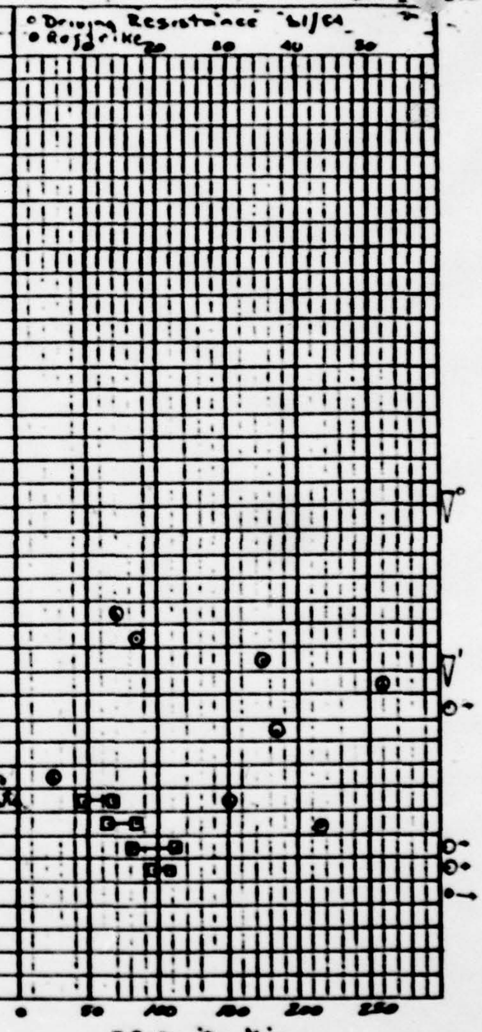
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

P. _ of _

ID No. 03 04 160 1 3500

Pile Type Douglas Fir — Hammer Vulcan V-1 — Date 24 Oct 78
Pile length 42.1' — Energy 15,000 — Time 1230 → 1335
Ground el. Trench Level — Operating Rate 60 blows/min — Inspector - Locke/[illegible]

Depth ft	Blows	Remarks
0-1		
2		Pre-jet to 20'
3		Pile runs to 16'
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16	↓	
17		
18		
19		
20		Much lignite at 20'
21		
22		
23		
24	19	
25	17	
26	35	
27	52	
28	61/11"	
29	37	
30	no data	
31	5	[illegible] Jet at 21' for 21 [illegible]
32	20	35' [illegible]
33	43	49 blows/min
34	61	
35	45	
	47 blows for [illegible]	Restrike on 10/25/78
		at 9:06 hrs



Dynamic measurements Yes

Sequence No.	Depth ft
01 (PDA)	30 - 35
02 (Restrike)	35 - 35.5

Notes: Pile batter at E.O.D.
0.1% N
0.5% E

■ Restrike
▽ Jetting

J.B.C.
10 Oct 80

WCC, VTC 835, Phase II
Vol II A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

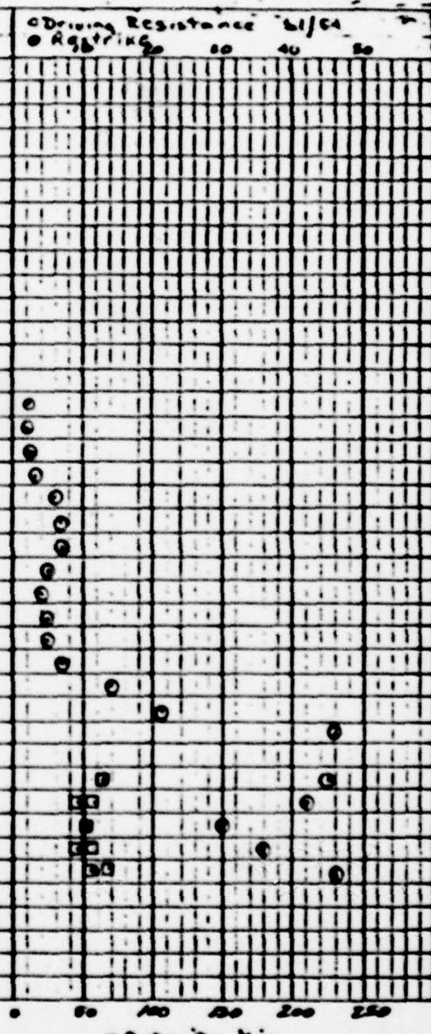
PILE DRIVING RECORD

P. _ of _

ID No. 03 04 160 1 3400

Pile Type	Douglas Fir	Hammer	Vulcan V-1	Date	24 Oct 78
Pile length	42.0 ft	Energy	15,000	Time	1340 → 1433
Ground el.	Trench Level	Operating Rate	60 blows/min	Inspector	Locke/Tsai

Depth ft	Blows	Remarks
0-1		
2		No jet to 25'
3		Pile ran to 14'
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15	2	
16	2	
17	2	
18	3	
19	6	
20	7	
21	7	
22	5	
23	4	
24	5	
25	5	
26	7	
27	12	
28	21	
29	96	
30	72	55 bl/min
31	45	
32	42	
33	30	
34	36	
35	31/8"	
	33/4.5"	Restrike on 10/25/78 at 09:15 hr



Dynamic measurements yes

Sequence No	Depth ft
01 (PDD)	30 - 34.75
02 (Restrike)	34.75 - 35.00

Notes:
Pile batter at E.O.D.
1.1% N
4.2% E

WCC, 77C823, Phase II
VOL III A

JHCL
10 Oct 78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

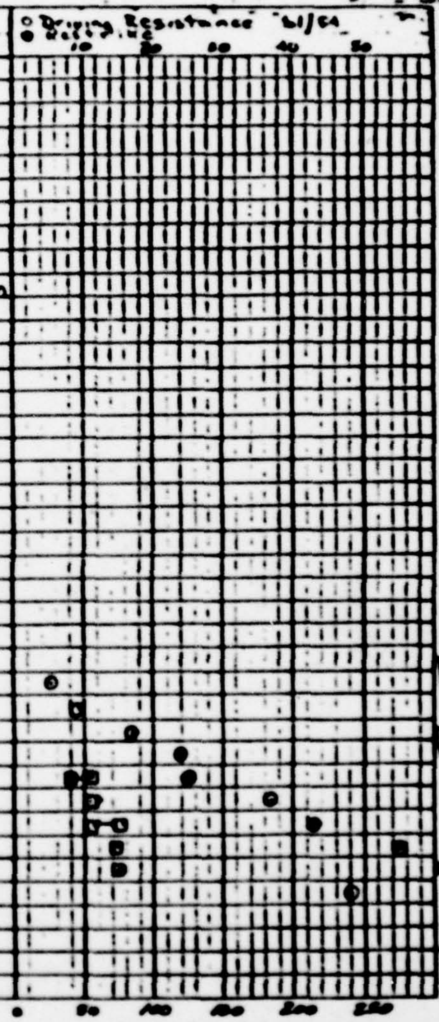
PILE DRIVING RECORD

P. _ of _

ID No. 03 04 I60 I 3300

Pile Type Douglas Fir — Hammer Vulcan #1 — Date 24 Oct 78
Pile length 42.0 ft — Energy 15,000 — Time 1440 → 1624
Ground el. Trench Level — Operating Rate 55 Blows/min — Inspector - Locke/Trio

Depth ft	Blows	Remarks
1440 0-1		
2		Pre-jet to 27'
3		Pile sinks 5'
4		
5		
6		
7		
8		
9		
10		3 Blows to drive pile from 5' to 26'
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27	5	
28	9	
29	17	
30	24	Analyzer
31	25	
32	37	
33	43	
34	55	
35	51/9"	
36	27/6¾"	Jet to 30'



Dynamic measurements yes

Sequence No.	Depth ft
0 / 333)	30 - 35.5

Notes:
Pile batter at 6.0.0.
3.1% S
0.0% W

WCC, VTC B25, Phase II
Vol IIA

JLT
10 Mar '80

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

P. _ of _

ID No. 03 04 160 1 3200

Pile Type	Douglas Fir (I)	Hammer	Vulcan V-1	Date	24 Oct 78
Pile length	42'	Energy	15,000	Time	1730 → 1902
Ground el.	Trestle Level	Operating Rate	60 Blow/min	Inspector	Kiser / Grieb

Time	Depth ft	Blows	Remarks	Driving Resistance bl/ft / Capacity, kips
1730	0-1	↓	During prejetting, jet stops at 19'-22', 23', 27' with good returns at 28';	
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
	16			
	17			
	18		Pile sinks 26'	
	19			
	20			
	21			
	22			
	23			
	24			
	25			
	26	↓		
1851	27	5		
	28	21		
	29	42		
1850	30	65	bubbles around pile	
1855	31	57		
	32	65		
	33	58		
	34	71		
1902	35	84/11	bubbles around pile	

Remarks (continued): logs in return water at 20'; piece of wood approx 8" x 3" x 15" washed at 27'

Driving Resistance bl/ft: 10, 20, 30, 40, 50
Capacity, kips: 0, 50, 100, 150, 200, 250

Dynamic measurements yes (30' to 35')

Sequence No.	Depth ft
01 (PDA)	30 - 35

Notes:
Pile batter at E.O.D.
1.7% S
2.0% E

■ Redrive
▽ Jetting

WCC, 77C B25, Phase II
Vol III A

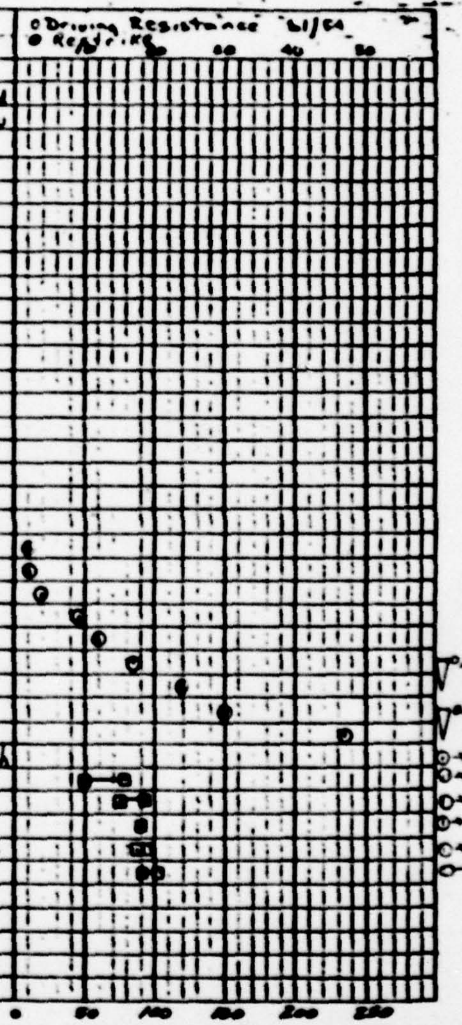
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

P. __ of __

ID No. 03 04 160 1 3100

Pile Type: Douglas Fir | Hammer: Vulcan V-1 | Date: 24 Oct 78
Pile length: 42 Ft | Energy: 15,000 | Time: 1910 → 2019
Ground el.: Trench Level | Operating Rate: 60 Blows/min | Inspector: Kisch/Kertal

Time	Depth Ft	Blows	Remarks
1910	0-1		During prejetting, jet
	2		drops to 22', 27' with good
	3		return; lignite in return
	4		water at 27';
	5		
	6		
	7		
	8		Pile sinks 10'
	9		
	10		
	11		
	12		
	13	2 blows from 10' to 15'	
	14		
	15		
	16		
	17		
	18		
	19	1 blow from 17' to 20'	
	20		
	21	2	
	22	3	
	23	4	
	24	9	
	25	12	
	26	17	
	27	24	
	28	30	
	29	47	
2000	30	72	Jet to 27', lignite in wash
	31	64	
	32	71	
	33	110	Jet to 29'
	34	111	Weak blows from hammer
2019	35	106	



Dynamic measurements yes (30' to 35')

Sequence No.	Depth Ft
01 (PDP)	30 - 35'

Notes:
Pile batter at E.O.D.
1.8% S
0.3% E

J.H.S.
10 Nov '78

OWCC, TTC 825, Phase II
VOL III A

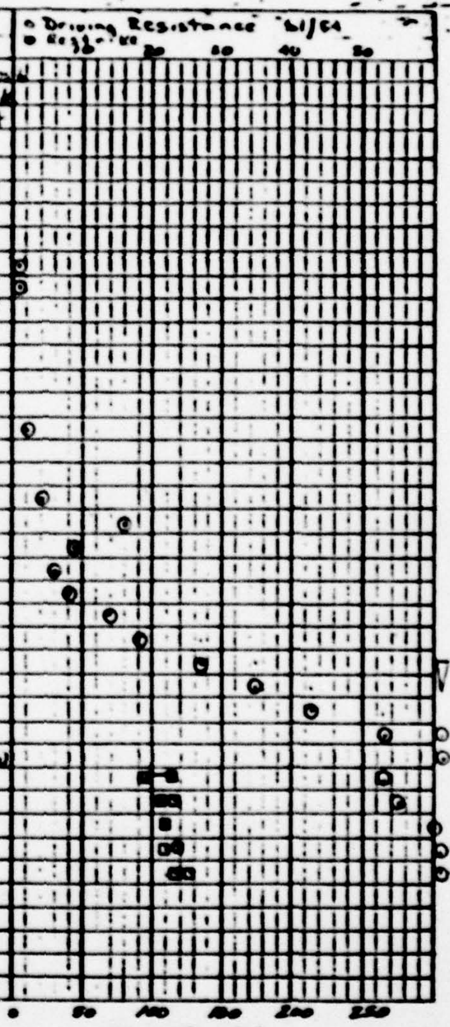
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

P __ of __

ID No. 05 04 160 1 2300

Pile Type Douglas Fir(I) Hammer Vulcan V-1 Date 24 Oct 78
Pile length 42' Energy 15,000 Time 2140 → 2310
Ground el. Track Level Operating Rate 60 blows/min Inspector - Koch/Green

	Depth ft	Blows	Remarks
2140	0-1		During prejetting, jet dropped
	2		22', 28', 27' slowly; lignite
	3		in return water with jet
	4		at 22'
	5		
	6		Pile sinks 10'; pulled
	7		up and repositioned;
	8		Pile sinks 8'
	9	1	
	10		
	11	3	blows; pile sinks to 16'
	12		
	13		
	14		
	15		
	16	2	
	17	3	blows, pile sinks to 18'
	18		
	19	4	
	20	16	
	21	9	
	22	6	
	23	8	
	24	14	
	25	18	
	26	27	
	27	35	
	28	43	
	29	53	
2240	30	86	Jet to 27', good return
	31	53	with lignite
	32	55	
	33	60	
	34	68	
2310	35	61/8"	



Dynamic measurements yes (30' to 35')

Sequence No.	Depth ft
01 (PDA)	30-35

Notes:
Pile batter at E.O.D
0.0% N
1.5% E

WCC, 77C833, Phase II
VOL. II A

JLCS
10 Oct 78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

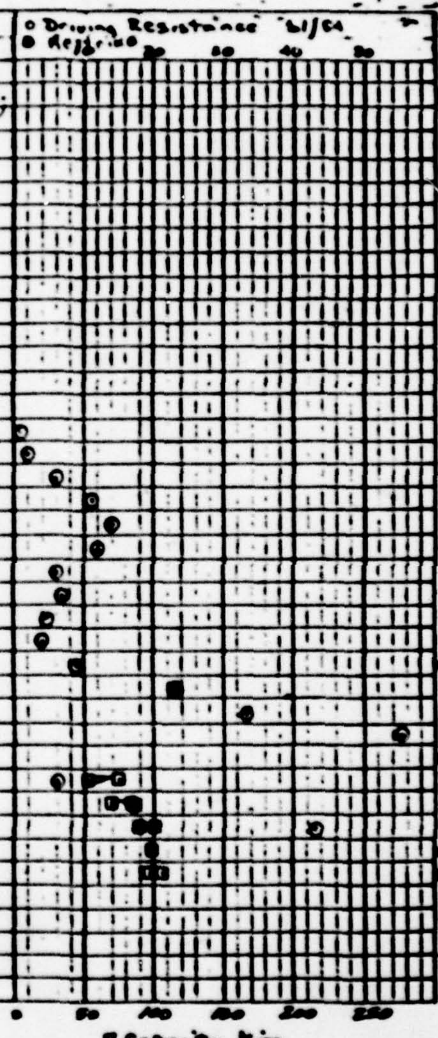
PILE DRIVING RECORD

P. __ of __

ID No. 08 04 160 1 2100

Pile Type Douglas Fir (T) | Hammer Vulcan VI | Date 24-25 Oct 78
Pile length 41'6" | Energy 15,000 | Time 2320 → 0108
Ground el. Trench level | Operating Rate 60 blows/min | Inspector - Kuch/Green

Time	Depth ft	Blows	Remarks
2320	0-1	↓	During prejetting, jet drops to 20', 15', 25', 29';
	2		lignite in return water;
	3		stop prejetting at 29'
	4		with good return
	5	↓	
	6	2	
	7	↑	
	8		Pile sinks 5'
	9		
	10	3 blows	
	11		
	12		
	13		
	14		
	15	↓	
	16	1	
	17	2	
	18	6	
	19	11	
	20	14	
	21	12	
	22	6	
	23	7	
	24	5	
	25	4	
	26	9	
	27	23	
	28	33	
	29	55	
0029	30	73	Jet to 27'; lignite in
	31	6	return water
	32	17	
	33	43	
	34	63	
0108	35	98/11"	



Dynamic measurements yes (30' to 35')

Sequence No.	Depth ft
21 (PDA)	30-35

Notes:
Pile batter at E.O.D.
1.3% S
2.6% E

● Redrive
▽ Jetting

✓ G.L.S.
10 Nov '78

WCC, TTC 825, Phase II, Vol II A

Y7C-825
Phase IV; Vol III A

Q.2 COMPLETE FIELD LOGS OF INSTALLATION OF TIMBER PILES UNDER MONOLITH M8

The identification number (Id. No.) at the top right-hand corner of each data sheet includes the timber pile number shown in Fig. 5.2, Volume III.

The timber pile number is given by the two digits preceeding the last two zeros of the Id. No. (for example, page Q-11 corresponds to timber pile No. 90)

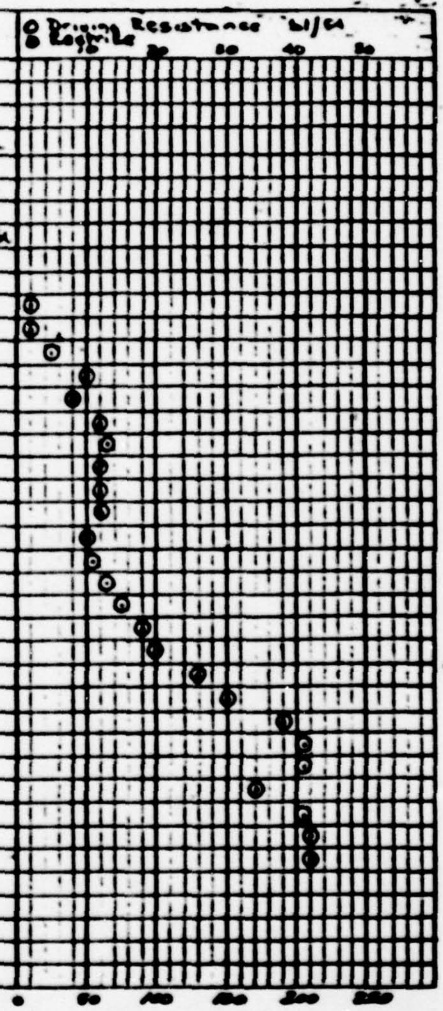
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 03 08 160 1 9000 p 1 of 1

Pile Type: Oak — Hammer: Vulcan VI — Date: 10/23/78
Pile length: 42 — Energy: 15,000 ft·lb — Time: 18:15 to 19:10
Ground el.: Trench Level — Operating Rate: 60 blows/min — Inspector: Keith J. Green

Depth ft	Blows	Remarks
0-1	↓	
2		Pre-jet to 27'
3		Pile lowered to 9'
4		sand and clay seen
5		in return water
6		large piece of wood
7		(5" x 0" x 2' approx)
8		seen in return water
9	↓	additional pieces in
10	1	return / very shallow
11	2	(scale)
12	2	
13	5	
14	10	
15	8	
16	12	
17	13	
18	12	
19	12	
20	12	
21	10	
22	11	
23	13	
24	15	
25	18	
26	20	
27	26	
28	30	
29	38	
30	41	
31	41	
32	34	
33	41	
34	42	
35	35 for 10"	



Dynamic measurements No
Sequence No. — Depth ft

Notes:

■ Restrike
▽ Jetting

J.D.C.L.
10 Aug '79

WCC, VTC 835, Phase II; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

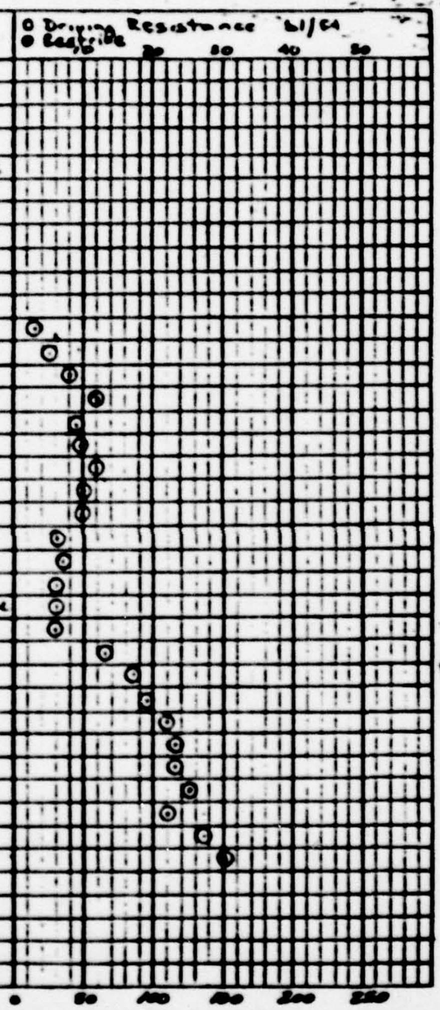
PILE DRIVING RECORD

P. 1 of 1

ID No. 08 08 160 1 9100

Pile Type	Oak	Hammer	Vulcan V1	Date	10/23/78
Pile length	42	Energy	15,000 ft lbs	Time	1912 - 1958
Ground el.	Trend Level	Operating Rate	60 Blows/min	Inspector	Koch/ [illegible]

Depth ft	Blows	Remarks
0-1	↓	
2		Pre-jet to 27'
3		Pile [illegible] to 11'
4		clay and lignite
5		[illegible] in [illegible] water
6		
7		
8		
9		
10		
11	↓	
12	3	
13	5	
14	8	
15	12	
16	9	
17	10	
18	12	
19	10	
20	10	
21	6	
22	7	
23	6	[illegible] of [illegible] from
24	6	23 [illegible], [illegible]
25	6	
26	13	
27	17	
28	19	
29	22	
30	23	
31	23	
32	25	
33	32	
34	27	
35	20 for 11"	



Dynamic Measurements No

Sequence No.	Depth ft

Notes:

[illegible]
10 Oct '78

WCC, TTC 835, Phase II; VOL III A

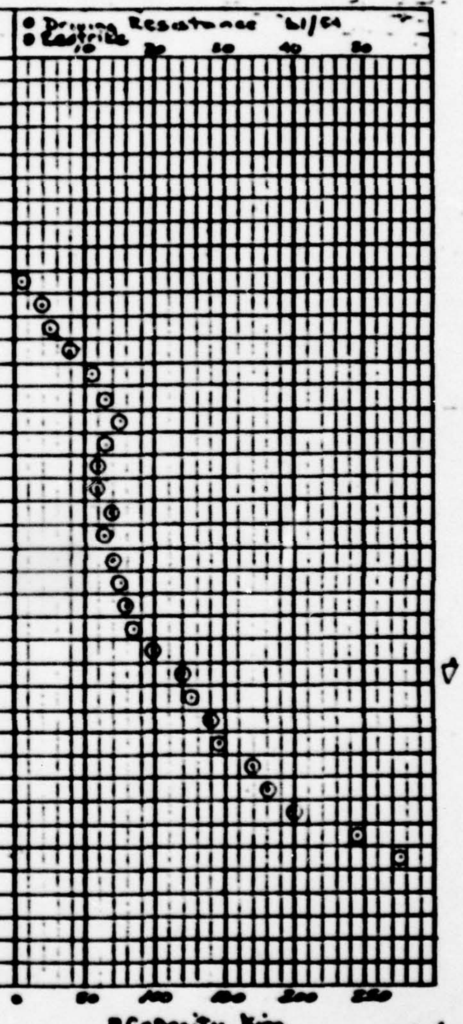
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

P. 1 of 1

ID No. 08 08 160 1 9200

Pile Type	Oak	Hammer	Vulcan VI	Date	10/23/78
Pile length	41'	Energy	15,000 ft-lb	Time	2010 to 2051
Ground el.	Trench level	Operating Rate	60 blows/min	Inspector	Koch / Spoen

Depth ft	Blows	Remarks
0-1	↓	
2		Pre-jetted to 27'
3		Pile sawn to 9'
4		clay and lignite in
5		return water
6		
7		
8		
9	↓	
10	1	
11	4	
12	5	
13	8	
14	11	
15	13	
16	15	
17	13	
18	12	
19	12	
20	14	
21	13	
22	14	
23	15	
24	16	
25	17	
26	20	
27	24	
28	25	
29	28	
30	29	
31	34	
32	36	
33	40	
34	49	
35	54 for 11½"	



Dynamic measurements No.

Sequence No.	Depth ft

Notes:

WCC, TTC 825, Phase II; VOL III A

J.H.E.L.
Nov '78

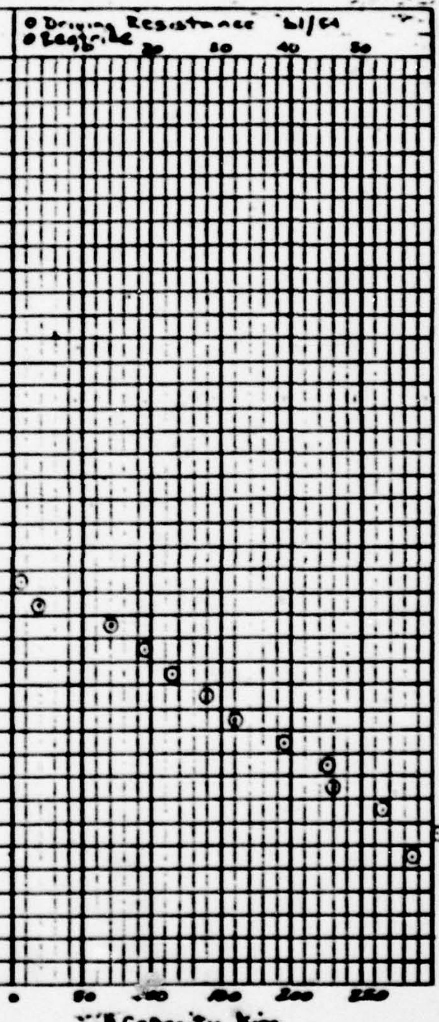
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST
PILE DRIVING RECORD

P. 1 of 1

ID No. 03 08 160 1 9500

Pile Type Douglas Fir (no wrap) Hammer Vulcan VI Date 10/23/78
Pile length 44 Energy 15,000 ft-lbs Time 22:00 to 22:30
Ground el. Trench Bed Operating Rate 60 blows/min Inspector - Koch / Green

Depth ft	Blows	Remarks
0-1		
2		No jet to 29'
3		Pile sank to 23'
4		
5		Lignite and clay in
6		return water. Good
7		return at 27' with
8		large quantity of
9		lignite, some pieces
10		1" long, one old
11		stick (1" diameter
12		and 8" long)
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23	1	
24	4	
25	14	
26	19	
27	23	
28	29	
29	32	
30	39	
31	45	
32	46	
33	53	
34	61	
35	57	



Dynamic Measurements No
Sequence No. Depth ft

Notes:

● Restrike
▽ Jetting

J.W.C.D.
10 Oct '78

WCC, TTC 815, Phase II ; VOL III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

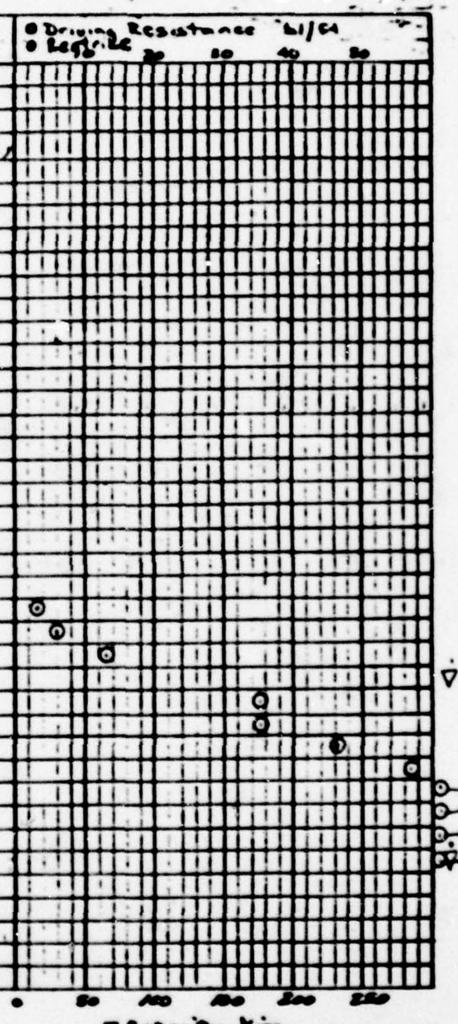
PILE DRIVING RECORD

P. 1 of 1

ID No. 08 08 160 1 9400

Pile Type	Douglas Fir (round)	Hammer	Vulcan VI	Date	10/23/78
Pile length	42' 9"	Energy	15,000 ft lbs	Time	2230 to 23:44
Ground el.	Trench level	Operating Rate	60 blows/min	Inspector	Kod / [illegible]

Depth ft	Blows	Remarks
0-1		
2		Augered to 35'
3		Pile sunk to 23'
4		Resulted in wash water,
5		cable rope pieces
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24	3	
25	6	
26	13	
27	no data	
28	35	
29	35	
30	46	
31	57	
32	76	
33	86	
34	81	
35	77 for 9"	



Dynamic measurements No

Sequence No.	Depth ft

Notes:

● Restrike

▽ Jetting

J. M. C. J.

10 Oct '78

WCC, TTC 825, Phase II, Vol. III A

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

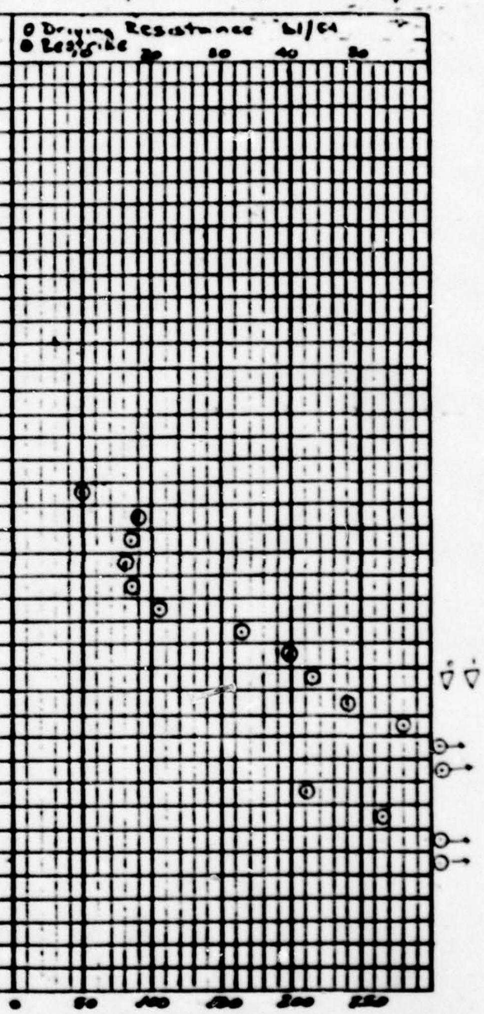
PILE DRIVING RECORD

P. 1 of 1

ID No. 08 08 160 1 9300

Pile Type: Douglas Fir (no ...) Hammer: Vulcan V1 Date: 10/23/78 - 10/24/78
Pile length: 44' Energy: 15,000 ft lbs Time: 2355 to 0105
Ground el.: Trench Level Operating Rate: 60 Blows/min Inspector: Kuck / Ryden

Depth ft	Blows	Remarks
0-1		
2		Pre jet to 27'
3		Pile sank to 18'
4		
5		Claystone fragments in
6		return water
7		clay lumps > 6"
8		diameter in return
9		water
10		
11		
12		
13		
14		
15		
16		
17		
18		
19	10	
20	18	
21	17	
22	16	
23	17	
24	21	
25	33	
26	40	
27	43	
28	48	
29	56	
30	61	
31	70	Jetted at 27'
32	42	
33	53	
34	64	
35	58 for 10"	



Dynamic Measurements No.
Sequence No. Depth ft

Notes:

o Refusal
▽ Jetting

10 Oct '78

PHASE IV REPORT

VOLUME IIIA

RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM

APPENDIX R

DETAILED ANALYSIS OF MONOLITH M2

TABLE OF CONTENTS

47C825
Phase IV; Vol IIIA

R DETAILED ANALYSIS OF MONOLITH M2

R.1 STATISTICAL ASSESSMENT OF DISPLACEMENT DATA SCATTER, MONOLITH M2

The provision for measuring monolith displacements at four corners of the rigid concrete block affords a redundancy suitable for an assessment of the relative scatter in the horizontal (y-direction) and vertical (z-direction) displacement measurements, in terms of estimated standard deviation of the data. Simple geometric identities, assuming a rigid concrete block (6 ft x 7 ft x 13 ft), are used to characterize the errors in a given set of measurements.

The measured horizontal displacement of the monolith for a given set of reading can be expressed as:

$$Y_i^R = y_i + Y_j^{LO} + Y_i^e \qquad \text{(eq 1)}$$

where:

- i = 5,6,7,8 identifies the four corners of the monolith, see fig. R.1;
- j = north and south, represents two survey lines (one passing north of the mono-lith, the other passing south) used to make theodolite/vernier caliper measurements, see fig. R.1;
- Y_i^R = recorded reading of y-displacement at corner i;
- y_i = actual y-displacement at corner i;

Y_j^{LS} : error in alignment of the theodolite the j^{th} survey line-of-sight; and

Y_i^{e} : error associated with vernier caliper sighting, reading, and heat wave distortions of line-of-sight.

It may be assumed that all the variables in eq 1, except y_i, are independent random variables. Furthermore it is assumed that the Y_j^{LS} and Y_i^e variables have zero mean values, and can be approximated by a normal distribution of their values about the statistical mean having standard deviations σ_{LS} and σ_e, respectively. These statements are represented symbolically by:

Y_j^{LS} independent and $\sim N(0, \sigma_{LS})$, and

Y_i^e independent and $\sim N(0, \sigma_e)$.

These assumptions simplify the statistical calculations made below. Further explanation of the statistical or probabilistic bases of this analysis may be found in any of several published texts on the subject.

For a rigid monolith, the displacement values satisfy the following relationship:

$$(y_6 - y_5) - (y_7 - y_8) = 0 \qquad \text{(eq 2)}$$

Substituting from eq 1, the error term involving the line-of-sight can be eliminated, leaving:

$$\frac{Y_6^a - Y_5^a}{2} - \frac{Y_7^a - Y_8^a}{2} = \frac{Y_6^e - Y_5^e}{2} - \frac{Y_7^e - Y_8^e}{2} = \Upsilon^e \quad \text{(eq 3)}$$

It can be shown that $\Upsilon^e \sim N(0, \sigma_e)$. For the optical survey measurements made during prototype pile driving at monolith M2, the values of Υ^e have been Calculated, and the scatter of these values is shown in Fig. R.2 vs prototype pile number. As described in Section 7.3.4., Volume III, the measurements made during splicing of prototype piles (at approximately soft pile tip penetration), are shown as intermediate data points on the corresponding figures. These same optical survey data are plotted on normal probability paper in Fig. R.3. The fact that these data plot roughly on a straight line supports the assumption of normal distribution for the random variable Υ^e.

An estimate of the standard deviation σ_e can be obtained based on the sample standard deviation s_e of the available data for Υ^e. For the optical survey data, the sample standard deviation is $s_e = 0.016$ in. (monolith M2 during prototype pile driving). A comparable analysis of the sample of corrected linear potentiometer data gives $s_e = 0.010$ in.

An alternative relationship for the rigid body displacement is given by:

$$\frac{(y_5+y_6)}{2} - \frac{(y_7+y_8)}{2} = 0 \qquad \text{(eq 4)}$$

Substituting from eq 1:

$$\frac{Y_5^R + Y_6^R}{2} - \frac{Y_7^R + Y_8^R}{2} = Y_N^{LS} - Y_S^{LS} + \frac{Y_5^e + Y_6^e}{2} - \frac{Y_7^e + Y_8^e}{2}$$

$$\equiv Y^{LSe} \qquad \text{(eq 5)}$$

It can be shown that $Y^{LSe} \sim N\left(0, \sqrt{2\sigma_{LS}^2 + \sigma_e^2}\right)$.

Evaluating the sample standard deviation for the optical survey data for monolith M2 during prototype pile driving, in terms of Y^{LSe}, one obtains:

$$S_{LS} = 0.020 \text{ in.}$$

The corresponding sample standard deviation based on corrected linear potentiometer data is:

$$S_{LS} = 0.031 \text{ in.}$$

Comparing S_{LS} values and S_e values, it is apparent that scatter induced by establishing the line-of-sight (setup of theodolite and sighting on survey target) was somewhat greater than that caused by any other factors.

The monolith displacement data shown in the report were given as the average of the four corner measurements. Thus, the magnitude of horizontal displacement is reported as:

$$\bar{Y} = \frac{Y_5^a + Y_6^a + Y_7^a + Y_8^a}{4} \qquad \text{(eq 6)}$$

By substituting from eq 1, the error in the value of $\bar{Y}$ can be expressed in terms of the individual errors as:

$$\bar{Y}^e = \frac{Y_N^{LS} + Y_0^{LS}}{2} + \frac{Y_5^e + Y_6^e + Y_7^e + Y_8^e}{4} \qquad \text{(eq 7)}$$

It can be shown that:

$$\bar{Y}^e \sim N(0, \sigma_{\bar{y}})$$

$$\text{where} \qquad \sigma_{\bar{y}} = \sqrt{\sigma_{LS}^2/2 + \sigma_e^2/4} \qquad \text{(eq 8)}$$

An estimate of standard deviation $\sigma_{\bar{y}}$ is therefore given for the sample as $s_{\bar{y}} = 0.016$ in. for the optical survey data, and as $s_{\bar{y}} = 0.022$ in. for the corrected linear potentiometer data. Discarding one obviously erroneous reading for the potentiometer data, both standard deviations are identical:

$$s_{\bar{y}} = 0.016 \text{ in.}$$

Following a similar procedure, the monolith settlement data (z-direction) can be represented as

$$Z_i^a = z_i + Z_i^e \qquad \text{(eq 9)}$$

where: Z_i^a = measured value of settlement at corner i;

z_i = actual settlement at corner i; and

Z_i^e = random error in reading $\sim N(0, \sigma_e)$

Assuming rigid body displacement :

$$(z_6 - z_5) - (z_7 - z_8) = 0 \qquad \text{(eq 10)}$$

or by substituting from Equation 9 :

$$\frac{Z_6^a - Z_5^a}{2} - \frac{Z_7^a - Z_8^a}{2} = \frac{Z_6^e - Z_5^e}{2} - \frac{Z_7^e - Z_8^e}{2}$$

$$\equiv Z_1^e \qquad \text{(eq 11)}$$

It can be shown that $Z_1^e \sim N(0, \sigma_{ez})$; and, based on optical level measurements on monolith M2 during prototype pile driving, one obtains an estimate of σ_{ez} from $s_{ez} = 0.026$ in. - For the corrected potentiometer data, the corresponding value is $s_{ez} = 0.006$ in.

In the report (Volume III), the settlements of the north and south ends of the monoliths were given separately. that is,

$$Z_N = \frac{Z_5^a + Z_6^a}{2}$$

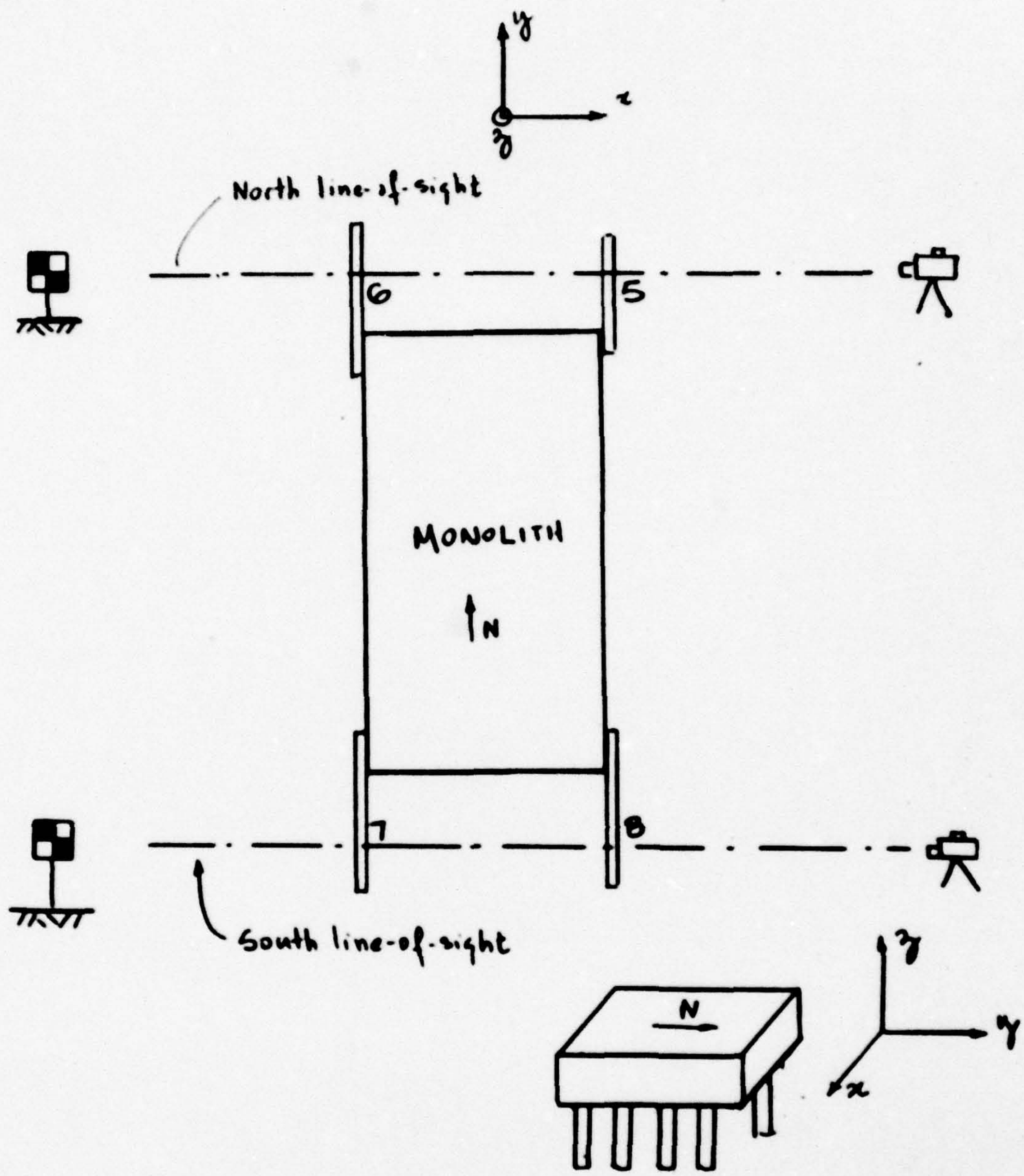
and

$$Z_S = \frac{Z_7^a + Z_8^a}{2}$$

It may be shown that $Z_j \sim (z_j, \sigma_{z_j})$, where $\sigma_{z_j} = \sigma_{ez}/\sqrt{2}$ - An estimate of this standard deviation is given for the optical survey data as $s_{z_j} = 0.019$ in., and for the corrected potentiometer data as $s_{z_j} = 0.004$ in.

In a similar manner, the respective sample standard deviation values were calculated for monoliths M1, M3 and M5 during prototype pile driving. These values are reported in Volume III, in Tables 7.3 through 7.6.

The approach described herein applies statistical theories to approximate a physical model; however, the results of such analyses provide a basis for estimating the magnitude of scatter in the measurements by taking advantage of the redundancy of displacement information obtained during testing. Considering the testing conditions, the degree of scatter achieved is small and to be expected.



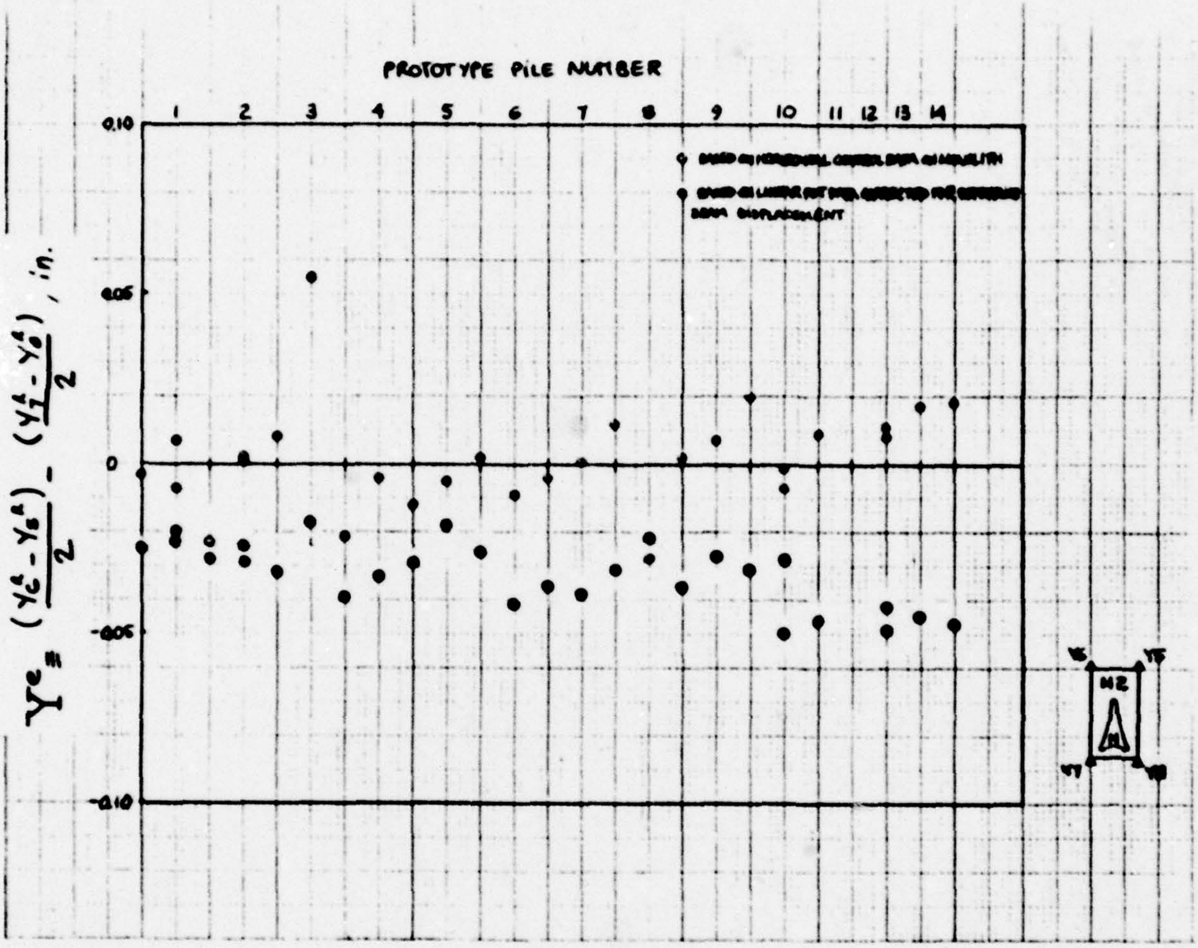
PILE DRIVING EFFECTS TEST PROGRAM

SCHEMATIC DIAGRAM OF SURVEY MEASUREMENTS FOR HORIZONTAL DISPLACEMENT

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-[illegible]

Woodward-Clyde Consultants
[illegible], Phase II ; Vol IIIA

Fig. R.1



PILE DRIVING EFFECTS TEST PROGRAM

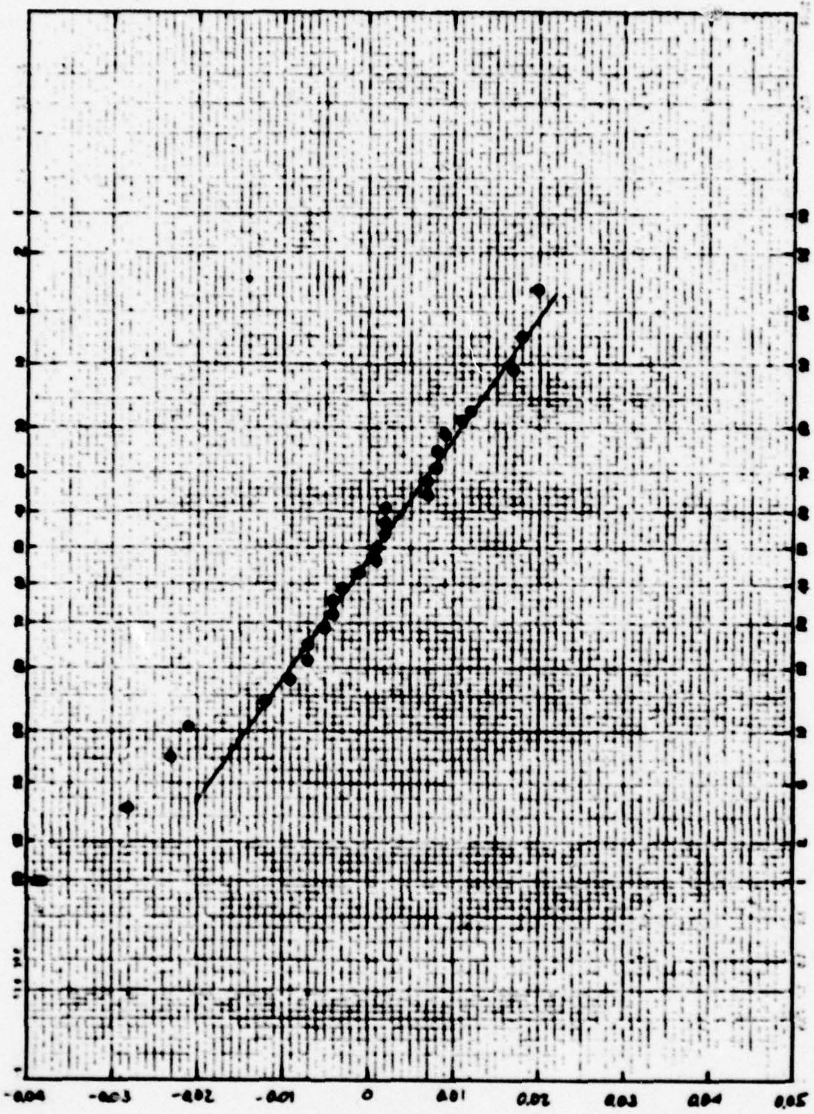
VARIATIONS OF Y^e WITH RESPECT TO READING EVENT

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants
770028, Phase III, Vol IIIA

Fig. R.2

(NORMAL PROBABILITY PAPER)



Y^e, in.

PILE DRIVING EFFECTS TEST PROGRAM

VALUES OF Y^e PLOTTED ON NORMAL PROBABILITY PAPER

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
[illegible]

Woodward-Clyde Consultants

[illegible], Phase III; Vol III A

Fig. R.3

Y7C-825
Phase IV ; Vol IV A

R.2 Predicted PERFORMANCE

R.2.1 Monolith Displacement. The following formula is a result of BARKAN'S attenuation law with Lo's reference velocity relationship applied to FEAGIN's data from Dam No. 11.

$$\text{Displacement per } B \text{ blow} = 0.0046\, B \left[\exp(0.488 \ln B + 0.7479) \sqrt{\tfrac{1}{r}}\ \exp(-0.03(r-1))\right]$$

R.2.2 Particle velocity.

Particle Velocity normalization for B = 10 blow/ft was done using Lo's (1977) equation modified for 14-in. H Piles.

$$V_i = \exp\left[0.488 \ln B_i + 0.7479\right]$$

V_i = Particle velocity (in./s) for any given blowcount.
B_i = Blowcount (blow/ft)

This formula is applicable for a rated hammer energy of 32,500 ft-Lb (VULCAN 010 Hammer)

For $B_i = 10$ blow/ft

$$V_{10} = \exp\left[0.488 \ln 10 + 0.7479\right] = 6.50 \text{ in./s}$$

$$\left[\frac{V_{10}}{V_i}\right] \times V_{measured} = V'_{10}$$

$$V'_{10} = \left(\frac{V_{10}}{\exp\left[0.488 \ln B_i + 0.7479\right]}\right) \times V_{measured}$$

V'_{10} : Particle Velocity normalized for a blowcount of 10 blow/ft

Results shown in Table R.1

Pile Tip Depth Range ft	Average Blowcount blow/ft	$V_{measured}$ in./s	Average Distance r from pile tip to monolith, ft	V'_{10}, in./s Vectorial Particle Velocity measured and normalized for B = 10 blow/ft
5-10	2.8	0.576	16.6	1.07
15-20	2.8	0.487	22.9	0.91
20-25	3	0.383	26.8	0.69
25-30	4.6	0.421	31.2	0.62
30-35	6.4	0.418	35.7	0.52
35-40	6.2	0.553	40.3	0.70
40-45	6	0.434	45.0	0.56
45-50	5.4	0.361	48.8	0.49

Pile Tip Depth Range ft	Average Blowcount blow/ft	$V_{measured}$ in./s	Average Distance r from pile tip to monolith, ft	V'_{10}, in./s Vertical Particle Velocity measured and normalized for B = 10 blow/ft
9-10	3	0.434	17.6	0.78
19-20	3	0.256	24.5	0.46
30-31	6	0.298	33.8	0.38
35-36	6	0.341	38.5	0.44
40-41	6	0.383	43.1	0.49
50-51	6	0.213	52.6	0.27

PILE DRIVING EFFECTS TEST PROGRAM
PREDICTED PERFORMANCE
PARTICLE VELOCITY

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0000

Woodward-Clyde Consultants
77C036, Phase II; Vol III A

Table R.1

PHASE IV REPORT

VOLUME IIIA

RESULTS AND INTERPRETATION OF PILE DRIVING EFFECTS TEST PROGRAM

APPENDIX S

DETAILS OF LOAD TESTED PROTOTYPE PILES

TABLE OF CONTENTS

S DETAILS OF LOAD TESTED PROTOTYPE PILES

S.1 DETAILED DESCRIPTION OF INSTRUMENTATION INSTALLATION

S.1.1 General

Six prototype piles were laterally load tested: three prototype piles HP 14x73 and three prototype piles PP 14x0.375. Pertinent properties and dimensions are given in Tables S.1a and S.1b, respectively.

S.1.2 Strain Gage Installation

Strain gages were mounted at eight levels along the piles, and at the same levels on both types of piles. Four gages were mounted at each level. The gages on the H piles were mounted on the inside of the flanges close to web, but beyond the edge of the roll radius; the gages on the pipe piles were mounted on the outside surface of the piles at 90-degree intervals (see Fig. S.1).

The gages installed on the prototype piles were Micro-Measurements (M-M) CEA-06-125UW-350 (gage factor 2.105+0.3 percent). Each gage was mounted on a steel shim stock with a terminal strip.

The gage location on the piles was first ground smooth, using a grinder with No. 100 abrasive disc. Then, the location was hand rubbed with No. 250 emery paper. To remove any traces of grease and other residues the location was cleaned with ethyl acetate and Instant FD Residue Clearner manufactured by Tech Spray, Amarillo, Texas.

Upon completion of the gage location preparation, the shim stock was welded to the prototype pile with an Ailtech spot welder having an output of 10 watts-second. The next step was to solder the lead wires to the terminal strip. Then, the installation was covered with M-M M-Coat A Polyurethane Coating followed by a layer of butyl rubber (M-M M-Coat FB-2).

After installation of all gages on one side, the lead wires were brought up to the top of the pile. They were fastened to the pile at 2 ft to 3 ft intervals using spot-welded U-brackets.

The cover plate or angle was then placed over the gages and welded into place. Welding was not permitted within 6 in. of the gage to reduce heat and the possibility of sparks damaging the installation.

To further protect the gages, the void under the cover plate or angle was filled with foam-in-place urethane insulation (Insta-Foam Froth Pak Kit, Insta-Foam Products, Joliet, Illinois). The insulation came with the two components separated and under pressure. The components were mixed in a nozzle. To inject

the insulation behind the cover plate or angle, 1/4-in. dia holes were drilled at 5 ft intervals.

S.1.3 Inclinometer Casing Installation

A 1.90-in.-id inclinometer casing was installed on the H pile inside a 4x4x1/4-in. angle welded to the pile. The protective angle extended full length to within 5 ft of the top of the pile and was tapered to a point near the tip. An assembled 50 ft length of inclinometer casing was inserted into the protective cover and the grooves were aligned, parallel and perpendicular to the axis of bending. Then, the void was filled with the urethane foam used to protect the strain gages.

Other investigators have installed inclinometer casings on H piles in a similar manner. During driving, their piles deviated considerably from their intended location. This behavior was attributed to the asymmetry of the pile cross section resulting from welding an angle on one side. In an attempt to prevent this from occurring with these H piles, an angle was wleded on the opposite side of the web to maintain symmetry of the section.

The inclinometer casing was installed in the pipe pile after driving and clean-out, just efore grout placement. The casing was held in place with four steel centralizers, the details of which are shown in Fig. S.2.

S.2 DETAILS OF PROTOTYPE PILE CALIBRATION PROCEDURES

S.2.1 General

After all instrumentation was installed, each prototype pile was loaded in bending to calibrate the gages. The prototype pile was supported on 6x8 timber beams resting on wood crib supports about 40 ft apart. Teflon pads (1/8-in. thick) were placed between the prototype pile and the beam to reduce sliding friction during testing. A schematic of the setup is given in Fig. S.3a.

An Enerpac 25-t capacity, double-acting jack was used to apply the loads to the prototype piles. The jack was activated with an air-operated hydraulic pump. The load applied by the jack was monitored with a 50-t, hollow cylindrical load cell. The load cell was read with a Vishay P-350 strain indicator.

Two prototype piles were calibrated at one time. After placement on the beams, the pipe piles were rotated so that the gages were at a 45-degree angle to the axis of loading. Then, two hoisting straps were chained around the prototype piles, as seen in Fig. S.3a. The positions of the jack and straps were selected to give a moment distribution similar to that expected during actual testing. The maximum load applied during calibration was limited by the strength of the straps. Positions of the jack and straps are given in Fig. S.3b.

The H piles were calibrated in two positions, the jack loading the flange of the prototype pile for both positions. The pipe piles were calibrated in two positions, 180 degrees apart.

S.2.2 Calibration Procedures

After the prototype piles and jack were positioned, calibration began. First, the load was cycled from zero to a maximum of three times. The purpose of these cycles was to exercise the gages, as was done with the timber piles. Then, two calibration load cycles were done. Each calibration cycle consisted of loading the piles between 0 and 15 t maximum in six equal increments. The maximum load was sustained for a period of five minutes for each cycle.

Strain gages were read with a Vishay VE-20 strain indicator in a quarter-bridge circuit.

S.2.3 Gage Checkout

Upon completion of calibration, the prototype piles were placed in water-filled, cased shafts, so that ground and gage resistances under submerged conditions could be tested. The prototype piles remained in the shafts for one hour before the resistance values were measured.

S.2.4 Strain Gage Bridges

After the calibration of the prototype piles, it was decided that the quarte-bridge circuits should be upgraded to half-bridge circuits. The compelling reason was to provide temperature compensation. In addition, the half-bridge circuit would give twice the output of the quarter-bridge circuit for a given strain.

To make the half-bridge circuit, gages, 180 degrees apart, at the same level were joined, so that one gage would be in compression and the other in tension. The half-bridge circuit was used during the load testing, except on pipe pile T4. The large number of bad gages on that prototype pile necessitated using only quarter-bridge circuits in order to obtain useful data.

S.3 COMPLETE DRIVING RECORDS OF PROTOTYPE PILES T1 AND T2, POSTGROUTED SOIL

(next page)

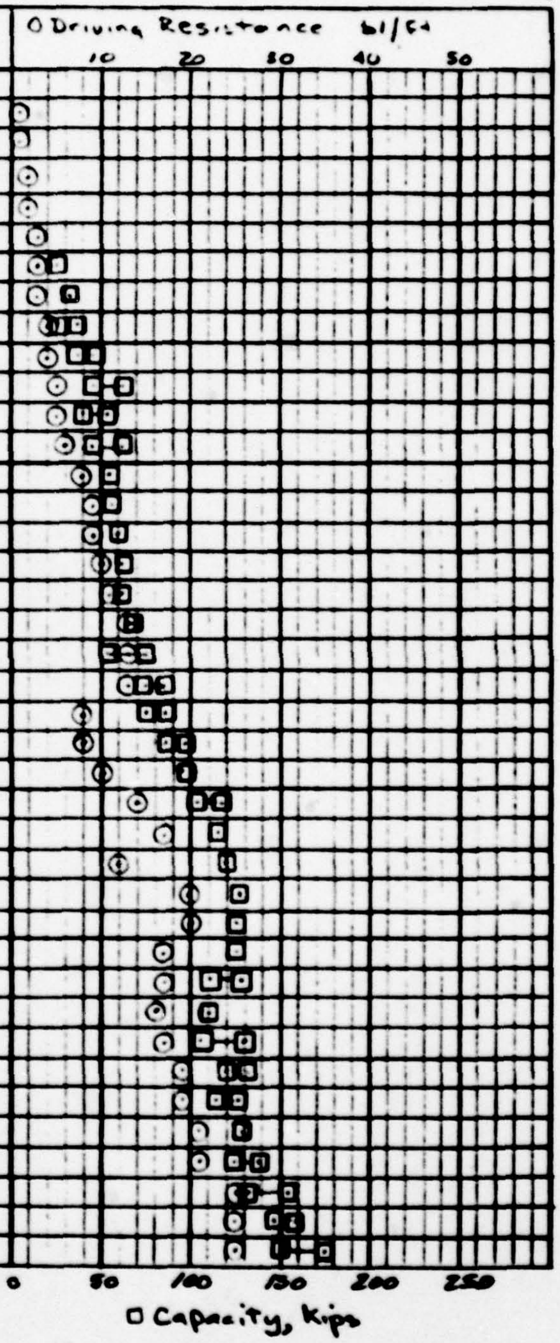
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 08 160 1 T0100

Pile Type	HP 14 x 73	Hammer	[illegible]	Date	9/8/78
Pile length	55	Energy	32,500 ft-lbs	Time	16:[illegible] to 18:20 hrs
Ground el.	[illegible]	Operating Rate	55 blows/min	Inspector -	[illegible]

Depth ft	Blows	Remarks
0-1	0	
2	1	
3	1	
4	2	Left [illegible] to
5	2	check alignment of pile
6	3	
7	3	at 17:43 hrs
8	3	
9	4	
10	4	
11	5	
12	5	
13	6	stopped at 17 45 hrs
14	8	started at 17 55 hrs
15	9	
16	9	
17	10	36 Blows/min
18	11	
19	13	
20	13	
21	13	stopped driving at 17:57
22	8	because leads not vertical
23	8	started at 18:05 hrs
24	10	
25	14	
26	17	
27	12	
28	20	
29	20	
30	17	
31	17	
32	16	41 Blows/min
33	17	
34	19	
35	19	
36	21	
37	21	
38	25	
39	25	
40	25	43 Blows/min



Dynamic Measurements yes

Sequence No.	Depth ft
61 (PDA)	7-50'

Notes:

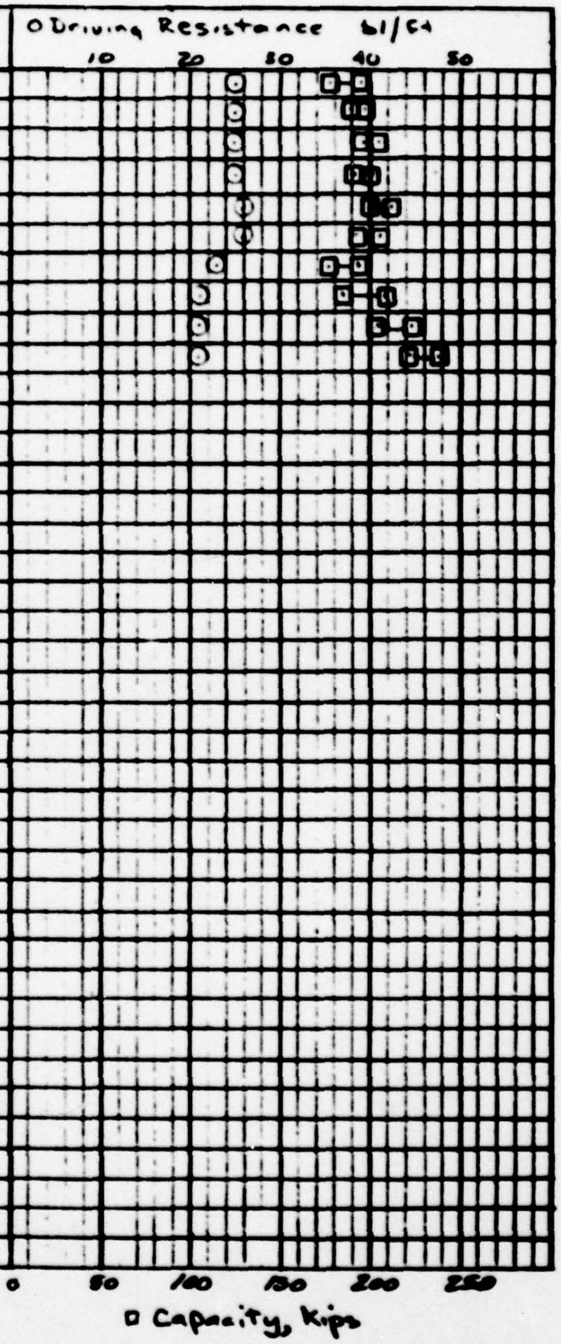
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 08 160 1 T0100

Pile Type	HP 14 [illegible]	Hammer	[illegible] 312	Date	11/8/78
Pile length	[illegible]	Energy	32,500 ft lbs	Time	[illegible] – 18.20 hrs
Ground el.	[illegible]	Operating Rate	50 blows/min	Inspector	Deepak Aggarwal

Depth ft	Blows	Remarks
41	25	43 blows/min
42	25	
43	25	
44	25	41 blows/min
45	26	
46	26	
47	23	
48	21	
49	21	
50	21	finished driving at 18.20 hrs



Dynamic measurements yes

Sequence No	Depth ft

Notes:

WCC, 77C825, Phase II; Vol III A

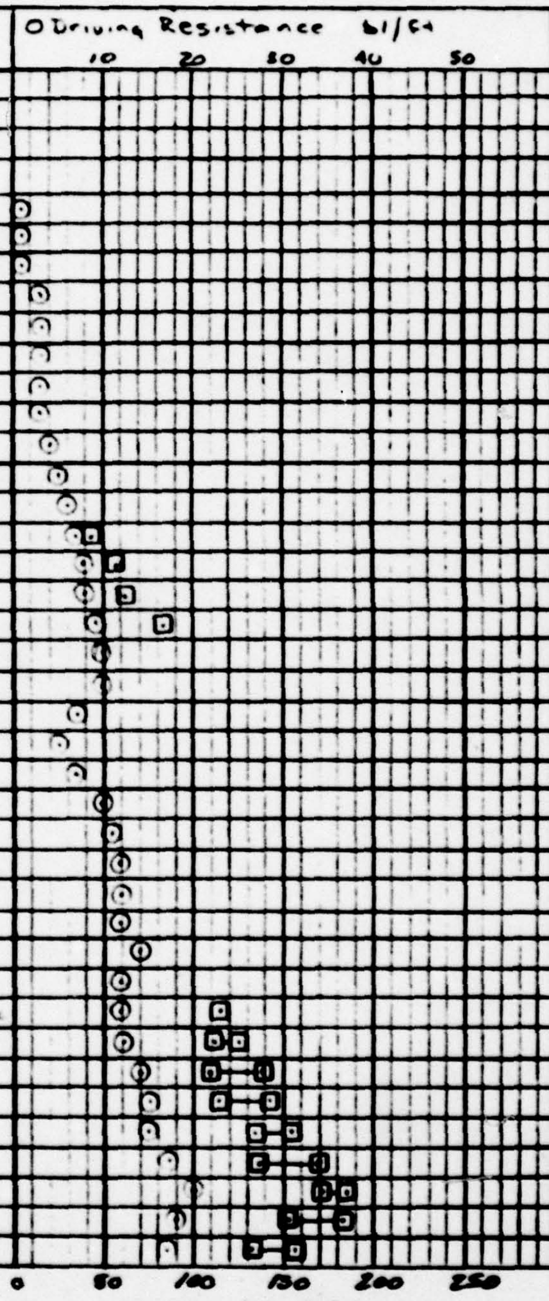
WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

ID No. 08 T2 160 1T0200

Pile Type PP 14 x 0.375 — Hammer [illegible] 312 — Date [illegible]
Pile length 55 — Energy [illegible] — Time [illegible]
Ground el. Trench [illegible] ≈ 391.5' — Operating Rate 50 blows/min — Inspector - [illegible]

Depth ft	Blows	Remarks
0-1	self weight	Time 20:30 hrs
2		
3		
4		
5	1	at 21:18 hrs
6	1	soft strikes of hammer
7	1	stopped at 21:20 hrs
8	3	started at 21:37 hrs
9	3	
10	3	
11	3	
12	3	
13	4	
14	5	
15	6	
16	7	
17	8	
18	8	40 blows/min
19	9	
20	10	
21	10	
22	7	
23	5	41 blows/min
24	7	
25	10	
26	11	
27	12	42 blows/min
28	12	
29	12	
30	14	
31	12	→ stopped at 21:45 hrs to
32	12	tighten gages for dynamic
33	12	measurement
34	14	
35	15	41 blows/min
36	15	
37	17	
38	20	43 blows/min
39	18	
40	17	



Dynamic measurements
Sequence No.	Depth ft
D1 (PDA)	19 - 50

Notes: [illegible] is only producing pressure of [illegible] 85 psi - not sufficient capacity

WCC, 77C825, Phase III; Vol III A

10 Oct '78

WOODWARD-CLYDE CONSULTANTS
LOCKS AND DAM NO. 26
PILE DRIVING EFFECTS TEST

PILE DRIVING RECORD

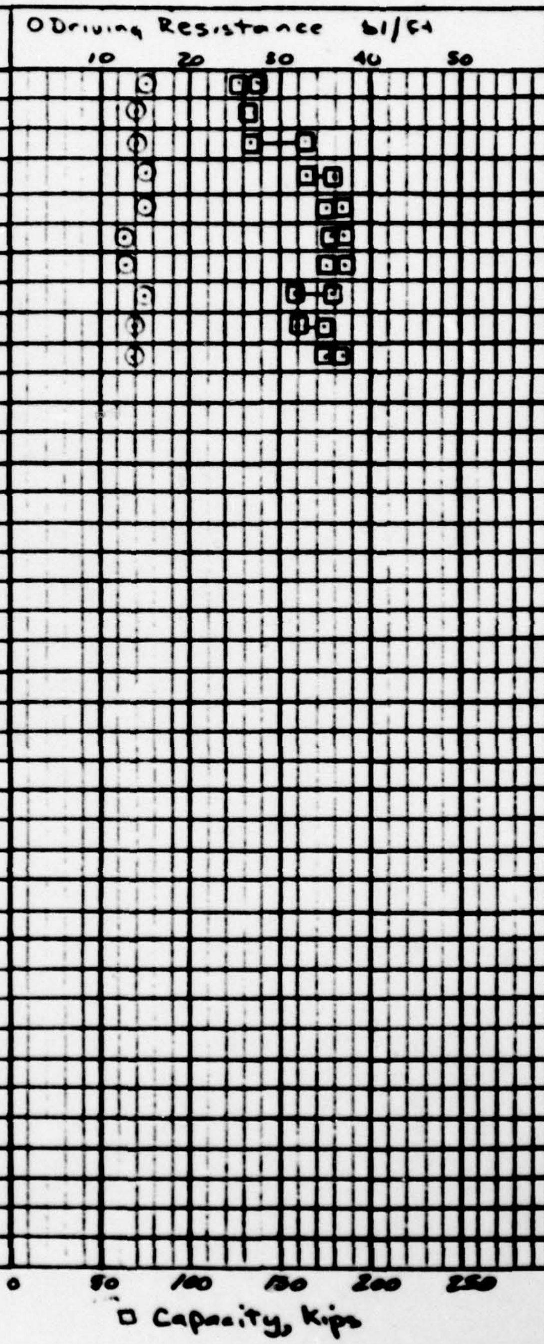
ID No. 08 T2 160 1T0200

Pile Type [illegible]
Pile length 55
Ground el. [illegible]

Hammer Vulcan 010
Energy 32,500 ft lbs
Operating Rate 50 blows/min

Date 1/2/78
Time
Inspector - Deepak Aggarwal

Depth ft	Blows	Remarks
41	15	
42	14	
43	14	43 blows/min
44	15	
45	15	
46	13	43 blows/min
47	13	
48	15	
49	14	
50	14	finished driving at 21 53 hrs



Dynamic measurements yes

Sequence No	Depth ft

Notes:

S.4 RESULTS OF LABORATORY TESTING ON STANDARD CYLINDER GROUT SAMPLES, PROTOTYPE PILES T2 AND T4

Standard concrete cylinders were taken of the grout mixtures used to fill prototype piles T2 and T4. They were sent to a commercial laboratory for testing. In addition to compressive strength, the elastic modulus of the specimens from prototype pile T2 was determined.

The laboratory reports are presented in the following pages.

Y7C825
[illegible] IV, Vol III A

FORM C

ANCO TESTING LABORATORY, INC.

1552 SOUTH 7TH, ST. LOUIS, MISSOURI 63104 • 314-241-0525
707 E. McCARTY ST., JEFFERSON CITY, MISSOURI • 314-635-5012

T2

Report No. A-151591

January 6, 1979

Woodward Clyde Consultants
P. O. Box No. 582
Alton, Illinois 62002

Project: Lock and Dam No. 26
Job No. Y7C825
Alton, Illinois

Attention: Mr. Rich Ashley

Gentlemen:

We report herewith results of Compressive Strength and Modulus of Elasticity Tests conducted on grout mix specimens cast in standard 6" x 12" cylinder molds. The specimens, cast on December 5, 1978, were transported to the laboratory by our representative on December 8, 1978.

GROUT MIX COMPRESSIVE STRENGTH TEST DATA

Cylinder Number	Age at Test-Days	Applied Load-Lbs.	Area Sq.In.	Strength Lbs/Sq.In.
12-5-1	7	48,000	28.27	1698
12-5-2	14	65,000	28.27	2299
12-5-3	28	84,800	28.27	2989

GROUT MIX MODULUS OF ELASTICITY TEST DATA

Cylinder Number	Age at Test-Days	Applied Load-Lbs.	Strength Lbs/Sq.In.	Unit Strain In Inches	Modulus of Elasticity-psi
12-15-4	7	15,200	538	0.000642	838,006
12-15-5	14	21,200	750	0.000612	1,225,490
12-15-6	28	32,800	1160	0.000569	2,038,664

The Modulus of Elasticity Stress-Strain Curve is attached and made a part of this report.

Respectfully submitted,

John T. Anderson

John T. Anderson
ANCO TESTING LABORATORY, INC.

JTA:ot
6-Woodward Clyde

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S-10

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Report No. A– 152261

February 19, 1979

ICOS Corporation
P. O. Box 583
Alton, Illinois 62002

Project– Mississippi River Lock & Dam No. 26
Foundation Investigation and Test Program
Contract No. DACW 43-78-B-0083

Attention: Mr. Gregg Sanchez

Gentlemen:

We report herewith results of compressive strength tests made on standard 6" x 12" concrete cylinders made by your representative.

COMPRESSIVE STRENGTH TESTS

Cylinder Number	1	2
Age at Test, Days	3	7
Strength, psi	2370	3059
Total Load, Lbs.	67,000	86,500
Type of Fracture	Regular	Regular
Date Made	02-10-79	02-10-79
Date Received	02-12-79	02-12-79
Date of Test	02-13-79	02-17-79
Type of Cement	Regular High Early Strength	~~Regular~~
Concrete Mix	Grout	Grout
Additive	- - - -	- - -
Curing	Standard	Standard
Slump, Inches	- - - -	- - - -
Specimen Represents	- - Steel Test Pipe Pile - T4 - - -	
Strength, psi(7 days) Report No.		

Respectfully submitted

John T. Anderson
ANCO TESTING LABORATORY, INC.

JTA:sak
6-ICOS

Cross-sectional area of uninstrumented prototype H pile	21.5 in^2
Cross-sectional area of instrumented prototype H pile	30.3 in^2
Moment of inertia of uninstrumented prototype H pile	734 in^4
Moment of inertia of instrumented prototype H pile	882 in^4
Elastic modulus	29.4×10^6 lb/in^2
Length	55 ft

(a) Prototype H pile properties and dimensions

Outside diameter	14.0 in.
Wall thickness	0.375 in.
Steel area of uninstrumented prototype pipe pile	16.1 in^2
Steel area of instrumented prototype pipe pile	18.9 in^2
Steel modulus	29.4×10^6 lb/in^2
Length	55 ft
Concrete area	131.9 in^2
Moment of inertia of uninstrumented prototype pipe pile after concrete placement	1927 in^4
Moment of inertia of instrumented prototype pipe pile prior to concrete placement	459 in^4

(b) Prototype pipe pile properties and dimensions

PILE DRIVING EFFECTS TEST PROGRAM

PROTOTYPE PILES PROPERTIES AND DIMENSIONS

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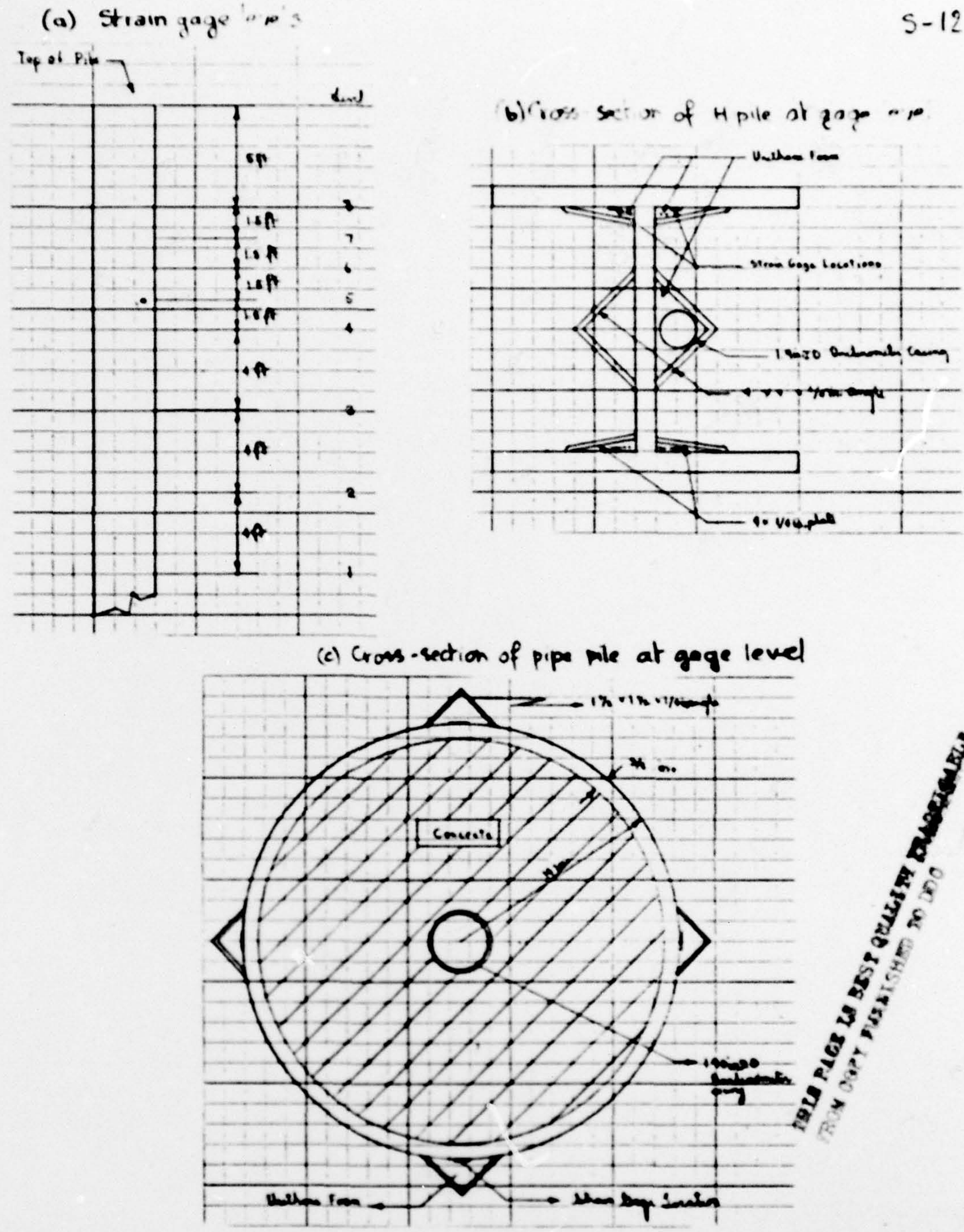
Table S.1



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GAGE LEVELS AND CROSS-SECTIONS OF PROTOTYPE PILES AT GAGE LEVEL

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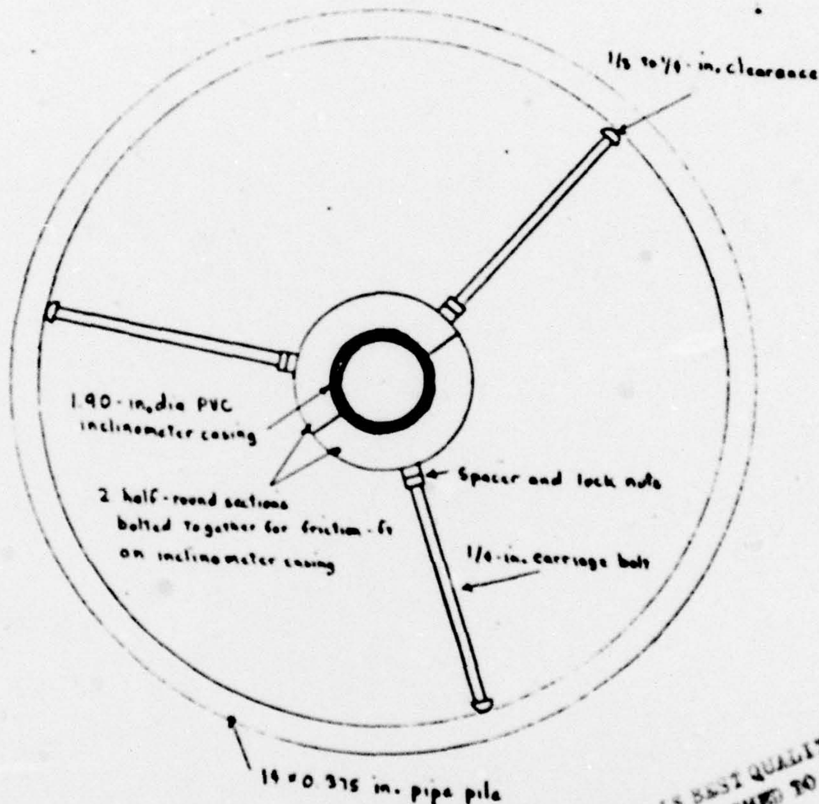
Fig. S. 1



PILE DRIVING EFFECTS TEST PROGRAM

DETAILS OF CENTRALIZER
PROTOTYPE PIPE PILE

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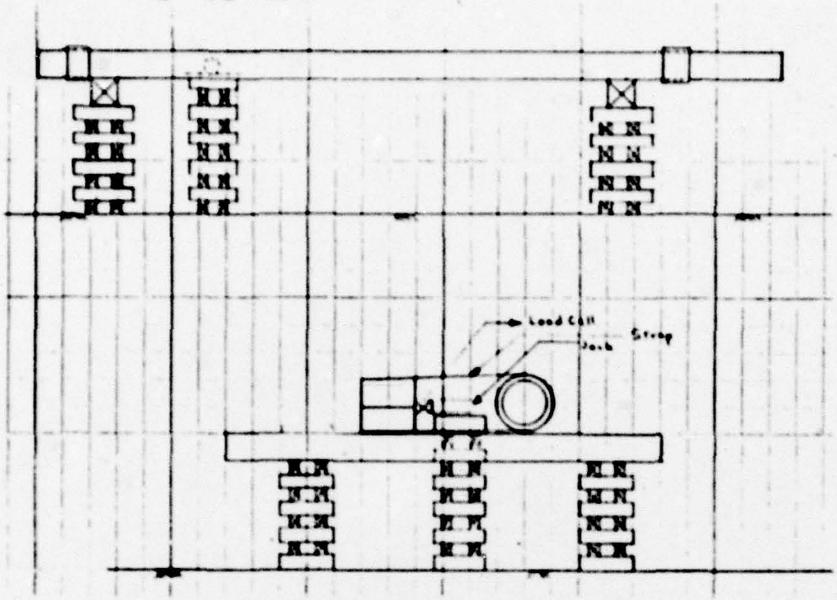
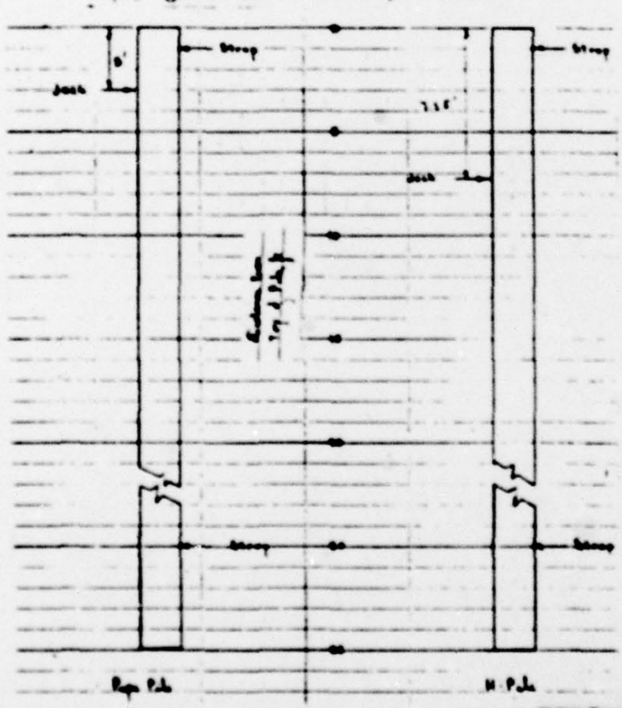
Fig. S.2

(a) Calibration setup



(b) Jack and straps location



PILE DRIVING EFFECTS TEST PROGRAM

CALIBRATION SETUP FOR PROTOTYPE PILES

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Fig. S. 3

PHASE IV REPORT

VOLUME IIIA

RESULTS AND INTERPRETATION OF
PILE DRIVING EFFECTS TEST PROGRAM

APPENDIX T

DETAILS OF ANALYSIS OF
MONOLITH-PILE-SOIL LOAD TRANSFER

TABLE OF CONTENTS

T.1 GENERAL

This appendix provides a basic overview of the data processing and analysis procedures used to evaluate the measurement data obtained during the pile driving effects tests. Emphasis is placed on the evaluation procedures for automatically acquired strain gage and geophone data using digital computer systems. The computer programs used in this study are described briefly to highlight the approach taken in the analyses, and delineate the inputs/outputs required for each step. The final section describes the statistical method used to assess the scatter observed in measurements of monolith displacements.

T.2 STRAIN GAGE DATA

The sequence of operations involved in processing strain gage data obtained by the Cyber II System (Appendix I) is outlined in Table T.1. During on-line testing, the data were recorded in compact form on the test (floppy) disc using the Cyber program ACQUIRE. These results were translated to a separate disc in a universal character format on the Cyber II. Subsequent steps converted these data into easily accessible form for analyses using Univac 1108 system programs (STX and READTAPE) to generate a permanent storage tape containing complete reading events as separate records. A simple WCC program (STRAINGAGE) is used to read the storage tape and select data from a given reading event for a particular pile, translate the data into card images for input to the analysis program MOMAX[3]

The program MOMAX employs these card image elements (gage stresses for a particular pile) along with appropriate geometric properties for the individual gages (eg, (x, y) gage coordinates, cross section area and respective moments of inertia), and gage ranks, as inputs to the calculations. A least-square fit of the stressplane at the respective gage level is used to compute axial thrust, bending moment, shear force and orientation of the maximum moment for that level. It should be noted that preliminary MOMAX analyses were performed using raw strain gage data and gage rankings based on calibration data (Section 3.3) in order to evaluate reliability of the individual strain gage readings. In the event that a particular gage reading deviated severely from the "best fit" plane, the gage rank was downgraded accordingly. The final analysis result presented in Section 9.5, Volume III, incorporated these adjusted rankings. MOMAX outputs include printouts of the input data and calculation results, plus plot files of these data for CALCOMP plotting purposes. Descriptions of the computer programs used in this process are given in Section T.4.

T.3 GEOPHONE DATA

The basic steps in the processing of geophone records are outlined in Table T.2. As described in Section 3.2.7, Volume III, the dynamic data acquisition system included complete oscillograph records (54 discrete channels), and selected analog magnetic tape records (14 discrete channels). The peak vibration monitors provided elevation of peak vectorial velocities for any four 3-D geophones on-line

during testing plus off-line replay capability from the magnetic tape recording. Manual processing of the peak component and vectorial velocities comprised the major effort expended in examining ground vibration characteristics.

Based on evaluations of these peak velocity data in conjunction with observed monolith displacements selected geophone records were digitized from the analog magnetic tape recordings for subsequent analysis. The digital magnetic tapes were thereafter translated from milivolts to raw velocity time histories for permanent tape storage using Univac 1108 system program STX and TRANSLATE along with WCC program VELOCITY.

The raw (uncorrected) velocity time histories are processed using the WCC program CALIBRATE, which incorporates such corrections as baseline, zero shift,k variations of instrument response for different frequencies, and cutt off high frequency noise, after which corrected velocity, acceleration, and displacement time histories are output for further analyses or plotting. Example response spectra were generated using program SPECTRA and plotted, along with representative time histories for presentation in Section 9.3, Volume III.

T.4 COMPUTER PROGRAMS

STX. A system program provided by Information Systems Design (ISD), for use on their Univac 1108 computer, to translate Binary Coded Data (BCD from geophone tapes) and ASCII data (from strain gage tapes) to Field data format tapes.

READTAPE. A program using an ISD subroutine to read the Fieldata strain gage tape and write it on a new tape as retrievable card image files for each record (measurement set) from the tape.

TRANSLATE. A program employing an ISD system routine used to read the Fieldata geophone data blocks and write them on new storage tape as card image files identified by title data blocks for retrieval.

STRAINGAGE. This program reads the files generated by READTAPE and retrieves card image elements for specified pile measurement in format suitable for analysis using MOMAX. It basically sorts through the stored data to provide input data elements for MOMAX[3] It is used in a runstream to create elements for processing (MOMAX).

MOMAX. This program calculates bending moment, axial thrust, and shear force for each strain gage level for a specified timber pile/measurement case. Moment and shear are computed in terms of in-plane (y) and transverse (x) components with respect to the y-axis of loading.

The piles are considered "bilinear" elastic in that different moduli may be considered in tension vs compression. Bending moment and thrust for a given strain gage level are obtained by passing a plane based on the least-square fit using weighted stress values (for 4 active gages), or the three stress values (for only

3 active gages) consistent with simple Ewer beam theory. Gages having ranking factors less than three are ignored, and levels having fewer than three gages ranked three or better are completely ignored. The shear force is computed as the slope of the moment distribution curve between two satisfactory gage levels.

CALIBRATE. The program can be used to correct a given time history for instrument response characteristics, cut off high frequencies, baseline correction and zero shift, and to calculate corrected velocity, acceleration and displacement time histories. All these operations, except the zero shift correction, are performed in the frequency domain using Fourrier transformation techniques. The zero correction is done in the time domain. Instrument response characteristics and frequency cut off considerations require assignment of appropriate digital filter parameters.

SPECTRA. The program calculates displacement, relative velocity, pseudo-relative velocity, acceleration, pseudo-acceleration, and acceleration magnification ratio spectral values for discrete single-degree-of-freedom systems (having arbitrary natural periods and damping ratios) and stores these values on a data file for plotting. It is used in a runstream to create elements for processing (SPECTRA) and/or plotting (EQPLOT).

REPLOT. This program reads in a two-dimensional array of data in any format and calls the CALCOMP subroutines necessary to generate (x, y) plot files. It permits generation of data points and/or lines based on arithmetic or logarithmic scales, and labels axes and legends as specified by the user.

EQPLOT. This code is used to plot earthquake time histories (acceleration, velocity, displacement, force and stress) using standard CALCOMP subroutines.

	STEP	PROGRAM	COMMENT
1	Acquire data and store on floppy disc	ACQUIRE (Cyber)	Micro Nova on-line storage
2	Translate stored data to universal format on disc	(Cyber)	From Cyber to ASCII format using Micro Nova off-line
3	Copy data from disc to computer-compatible magnetic digital tape	(Data General Vendor)	Done at remove site (STL)
4	Translate data on tape to system compatible FORTRAN readable tape	STX (Univac Vendor)	
5	Read tape and process into smaller data units on file	READTAPE	Permanent record storage tapes
6	Read file and process into elements representing each individual pile for a given data set	STRAINGAGE	Format data for input to MOMAX, individually accessible elements
7	Read strain gage data, pile geometry/property data into program and compute moment, thrust and shear; write output in accessible form for plotting and print out results	MOMAX	Requires external input of pile properties; plots done selectively with output data sets using CALCOMP software

PILE DRIVING EFFECTS TEST PROGRAM
STRAIN GAGE DATA
PROCESSING SEQUENCE

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Table T. 1

	STEP	PROGRAM	COMMENT
1	Acquire data and store on: a. Oscillograph paper b. S4 paper tape printout c. FM magnetic tape		Replay mag tape through S4 to maximize output
2.	Manually process oscillograph and S4 outputs		Tabulate component and vectorial peaks
3	Digitize analog magnetic tape records onto computer-compatible magnetic tape using Biomation unit		Converted onsite, off-line, using selected records
4	Translate digital data on tape to FORTRAN-readible format	STX (Univac Vendor)	
5	Read tape and write each block of data as separately accessible records	TRANSLATE	
6	Read appropriate title block and data block and convert raw data to uncorrected velocity for permanent storage on tape	VELOCITY	Converts from millivolts to in./s
7	Read uncorrected velocity and filtering requirements and convert to corrected velocity, compute acceleration and displacement time histories	CALIBRATE	Corrects for instrument response variations, cuts off high frequencies, baseline corrects, etc., and generates files
8	Compute response spectra from corrected acceleration time histories	SPECTRA	Generates plot files for CALCOMP plot programs

PILE DRIVING EFFECTS TEST PROGRAM

GEOPHONE DATA PROCESSING SEQUENCE

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Table T.2